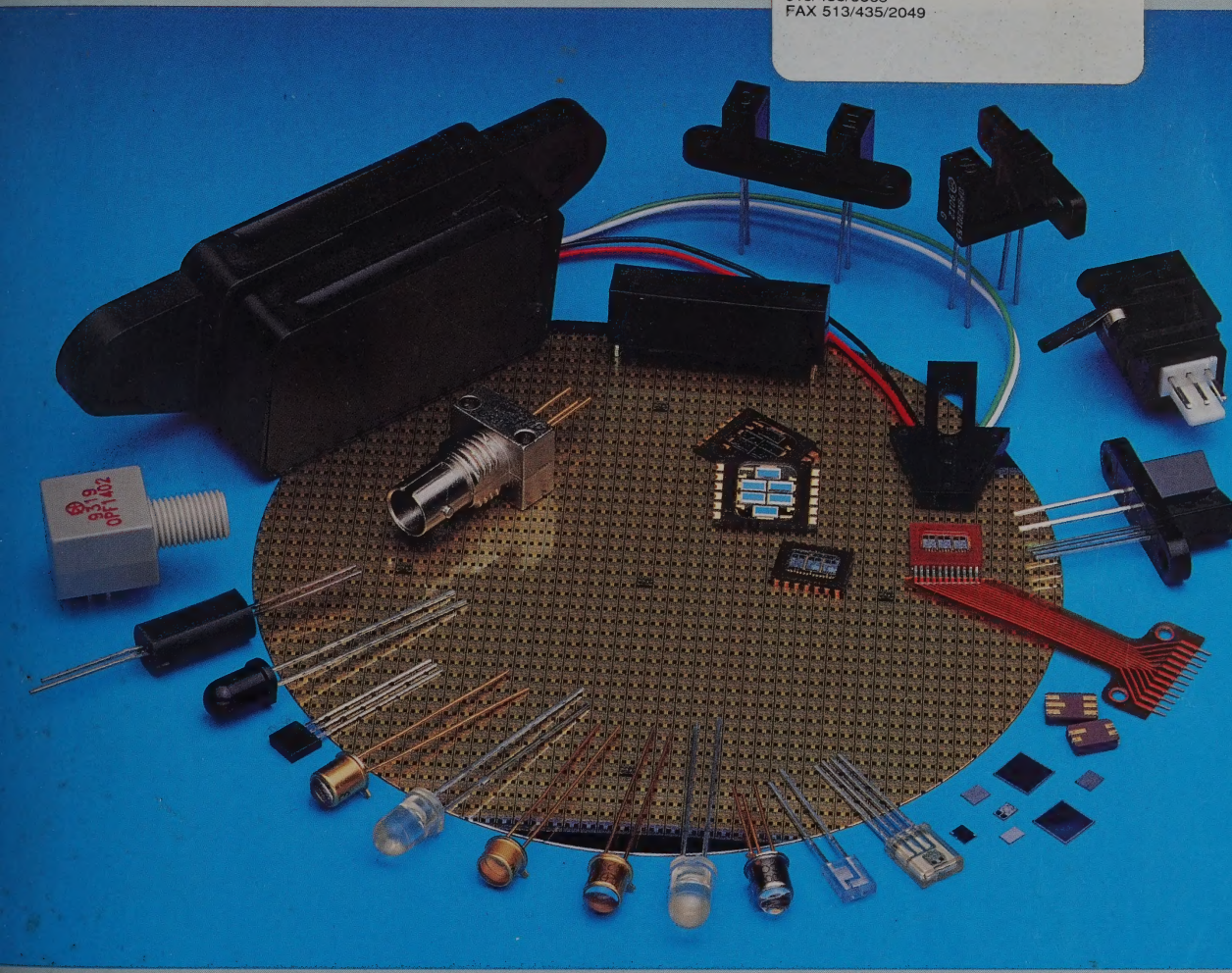
OPTEK TECHNOLOGY, INC.

# PRODUCT CATALOG

ARROW ELECTRONICS, INC.
ARROW/SCHWEBER ELECTRONICS GROUP
8200 WASHINGTON VILLAGE DRIVE
CENTERVILLE, OH 45458
513/435/5563
FAX 513/435/2049



*Engineered Solutions...*

## INFRARED OPTOELECTRONICS
## MAGNETIC SENSORS
## FIBER OPTICS
## HI-REL SERIES

WE/55

# OPTEK TECHNOLOGY, INC.

# PRODUCT CATALOG

©Optek Technology, Inc.
1993
All rights reserved.

500-0090-088

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# OPTEK TECHNOLOGY, INC.

## 1993 Product Catalog

Optek Technology, Inc. is the world's leading manufacturer of standard and custom sensing solutions using infrared and magnetic sensors.

## Engineering

For over 25 years, we have built our success upon a customer oriented team committed to technical leadership. Our engineers are the industry's most experienced and innovative. We manufacture three styles of product:

- Standard Components
  - As described in this catalog.
- Special Components
  - Electrical or mechanical variations of our standard components.
- Custom Sensor Systems
  - We are the industry experts, from concept and design to final assembly of fully custom sensors, using infrared or hall effect technologies.

## Quality/Reliability

Quality and reliability are designed-in at Optek from the initial product concept. At Optek we are committed and dedicated to being the Quality Leader in the markets we serve. Our internal program is known as **Excellence Through Quality**.

This program includes not only manufacturing but all facets of the Optek organization.

In short, Excellence Through Quality requires the participation of the total company doing its very best to recognize and achieve customer requirements.

**Optek is dedicated to delivering defect free, competitive products and services, on-time, to meet the requirements of our customers.**

## Total Vertical Integration

Optek is a highly vertically integrated sensor and component manufacturer. Vertical integration assures complete control of the total manufacturing cycle. Furthermore, vertical integration allows customization for application specific sensors from concept and design to final assembly and test.

- Concept and Design
- Wafer Fabrication
- Discrete Component Manufacturing
- Tooling and Plastic Manufacturing
- Printed Circuit Board Fabrication
- Wire and Cable Manufacturing
- Final Assembly and Test

The entire product line is designed to provide the product you need to satisfy your most demanding requirements. Optek has the industries' broadest line of standard components plus the capability to customize the components to individual needs.

**We invite you to join the growing number of satisfied customers using Optek sensors, Fiber Optic components and Military Processed components.**

**To find out more about Optek products and solutions, or for technical assistance, call our technical sales department at:**

**214-323-2200**

**214-323-2396 (FAX)**

# TABLE OF CONTENTS


PRODUCT SELECTION GUIDE ..... 1-1

INFRARED EMITTING DIODES ..... 2-1

PHOTOSENSORS ..... 3-1

PHOTOLOGIC™ SENSORS ..... 4-1

EMITTER AND PHOTOSENSOR MATCHED PAIRS ..... 5-1

OPTICALLY COUPLED ISOLATORS ..... 6-1

EMITTER AND PHOTOSENSOR CHIPS ..... 7-1

FIBER OPTIC COMPONENTS ..... 8-1

HYBRID ASSEMBLIES ..... 9-1

HALL EFFECT SENSORS ..... 10-1

# TABLE OF CONTENTS


REFLECTIVE OBJECT SENSORS . . . . . 11-1

SLOTTED OPTICAL SWITCHES . . . . . 12-1

HI-REL OPTOELECTRONIC COMPONENTS . . . . . 13-1

HI-REL FIBER OPTIC COMPONENTS . . . . . 14-1

HI-REL HALL EFFECT SENSORS . . . . . 15-1

HI-REL SURFACE MOUNT SEMICONDUCTORS . . . . . 16-1

GLOSSARY . . . . . 17-1

APPLICATION BULLETINS . . . . . 18-1

PART NUMBER INDEX . . . . . 19-1

AUTHORIZED DISTRIBUTORS & SALES OFFICES . . . . . 20-1

OPTEK TECHNOLOGY, INC.

# PRODUCT SELECTION GUIDE

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# PRODUCT SELECTION GUIDE

OPTEK

## DISCRETE COMPONENTS

| PART NUMBER | DESCRIPTION |
|---|---|
| OP1XX | GaAs INFRARED LIGHT EMITTING DIODE |
| OP2XX | GaAlAs INFRARED LIGHT EMITTING DIODE |
| OP3XX | PHOTODARLINGTON |
| OP5XX | PHOTOSENSOR |
| OPL5XX | PHOTOLOGIC™ SENSOR |
| OP6XX | PHOTOTRANSISTOR |
| OP8XX | PHOTOSENSOR |
| OPL8XX | PHOTOLOGIC™ SENSOR |
| OP9XX | PHOTODIODE |
| OPSXXX | EMITTER AND SENSOR MATCHED PAIR |
| OPXXXX | SPECIAL OR CUSTOM DISCRETE OPTOELECTRONIC COMPONENT |
| OHNXXXX | HALL EFFECT SENSOR |
| OHSXXXX | HALL EFFECT SENSOR (HIGH TEMPERATURE) |
| OHDXXXX | SPECIAL OR CUSTOM HALL EFFECT DISCRETE |
| OPCXXXX | CHIPS SUFFIX TP (SAWN ON TAPE)<br>SUFFIX WP (WAFFLE PACK)<br>SUFFIX VP (VIALS) |
| OMH | MILITARY HALL EFFECT |

## ASSEMBLIES

| | |
|---|---|
| OHBXXXX | HALL EFFECT ASSEMBLY |
| OPB6XX | LOW-COST REFLECTIVE, TRANSMISSIVE, AND FLAG SWITCHES |
| OPB7XX | REFLECTIVE OBJECT SENSOR |
| OPB8XX | SLOTTED OPTICAL SWITCHES, PHOTOTRANSISTOR OUTPUT |
| OPB9XX | SLOTTED OPTICAL SWITCHES, PHOTOLOGIC™ OUTPUT |
| OPBXXXX | OPTICAL SWITCH, SPECIAL OR CUSTOM PACKAGE |
| OPF1XXX | FIBER OPTIC TRANSMITTER |
| OPF2XXX | FIBER OPTIC RECEIVER |
| OPF3XX | FIBER OPTIC LED |
| OPF4XX | FIBER OPTIC SENSOR |
| OMFXXX | MILITARY FIBER OPTIC LED OR SENSOR |
| OPIXXX | OPTICALLY COUPLED ISOLATOR |

## SURFACE MOUNT

| | |
|---|---|
| HCCXXX | SURFACE MOUNT OPTOCOUPLER |
| HCTXXX | SURFACE MOUNT TRANSISTOR |
| HDCXXX | SURFACE MOUNT LOGIC OPTOCOUPLER |
| OPRXXXX | HYBRID OPTICAL ASSEMBLY |

# Infrared-Light Emitting Diodes (IRED's)

| Part No. | Case Style | Type | Output Power $E_{e(APT)}$ ($mW/cm^2$) | | Test Conditions | Beam Angle | Page No. |
|---|---|---|---|---|---|---|---|
| | | | Min | Max | $I_F$(mA) | (Deg.) | |
| OP123 | Pill, lensed | GaAs | 0.4 | — | 50 | 24 | 2-4 |
| OP124 | Pill, lensed | GaAs | 1.0 | — | 50 | 24 | 2-4 |
| OP130 | TO-46, lensed | GaAs | 1.0* | — | 100 | 18 | 2-6 |
| OP130W | TO-46 | GaAs | 1.0* | — | 100 | 50 | 2-8 |
| OP131 | TO-46, lensed | GaAs | 3.0* | — | 100 | 18 | 2-6 |
| OP131W | TO-46 | GaAs | 3.0* | — | 100 | 50 | 2-8 |
| OP132 | TO-46, lensed | GaAs | 4.0* | — | 100 | 18 | 2-6 |
| OP132W | TO-46 | GaAs | 4.0* | — | 100 | 50 | 2-8 |
| OP133 | TO-46, lensed | GaAs | 5.0* | — | 100 | 18 | 2-6 |
| OP133W | TO-46 | GaAs | 5.0* | — | 100 | 50 | 2-8 |
| OP140A | Plastic lateral | GaAs | 0.4 | — | 20 | 40 | 2-10 |
| OP140B | Plastic lateral | GaAs | 0.3 | 0.55 | 20 | 40 | 2-10 |
| OP140C | Plastic lateral | GaAs | 0.2 | 0.4 | 20 | 40 | 2-10 |
| OP140D | Plastic lateral | GaAs | 0.1 | — | 20 | 40 | 2-10 |
| OP145A | Plastic lateral | GaAs | 0.4 | — | 20 | 40 | 2-12 |
| OP145B | Plastic lateral | GaAs | 0.3 | 0.55 | 20 | 40 | 2-12 |
| OP145C | Plastic lateral | GaAs | 0.2 | 0.4 | 20 | 40 | 2-12 |
| OP145D | Plastic lateral | GaAs | 0.1 | — | 20 | 40 | 2-12 |
| OP163A | Plastic T-1 | GaAs | 1.4 | — | 20 | 18 | 2-14 |
| OP163B | Plastic T-1 | GaAs | 1.4 | 2.20 | 20 | 18 | 2-14 |
| OP163C | Plastic T-1 | GaAs | 0.85 | 1.60 | 20 | 18 | 2-14 |
| OP163D | Plastic T-1 | GaAs | 0.28 | — | 20 | 18 | 2-14 |
| OP164A | Plastic T-1 | GaAs | 1.4 | — | 20 | 18 | 2-16 |
| OP164B | Plastic T-1 | GaAs | 1.4 | 2.20 | 20 | 18 | 2-16 |
| OP164C | Plastic T-1 | GaAs | 0.85 | 1.60 | 20 | 18 | 2-16 |
| OP164D | Plastic T-1 | GaAs | 0.28 | — | 20 | 18 | 2-16 |
| OP165A | Plastic T-1 | GaAs | 1.95 | 3.70 | 20 | 18 | 2-18 |
| OP165D | Plastic T-1 | GaAs | 1.40 | — | 20 | 18 | 2-18 |
| OP165W | Plastic T-1 | GaAs | 0.5* | — | 20 | 90 | 2-20 |
| OP166A | Plastic T-1 | GaAs | 1.95 | 3.70 | 20 | 18 | 2-22 |
| OP166D | Plastic T-1 | GaAs | 1.40 | — | 20 | 18 | 2-22 |
| OP166W | Plastic T-1 | GaAs | 0.5* | — | 20 | 90 | 2-24 |
| OP168FA | Plastic end-looker | GaAs | 0.48 | — | 20 | 104 | 2-26 |
| OP168FB | Plastic end-looker | GaAs | 0.43 | 0.73 | 20 | 104 | 2-26 |
| OP168FC | Plastic end-looker | GaAs | 0.27 | — | 20 | 104 | 2-26 |
| OP169A | Plastic end-looker | GaAs | 0.180 | — | 20 | 46 | 2-28 |
| OP169B | Plastic end-looker | GaAs | 0.108 | 0.220 | 20 | 46 | 2-28 |
| OP169C | Plastic end-looker | GaAs | 0.027 | — | 20 | 46 | 2-28 |
| OP223 | Pill, lensed | GaAlAs | 1.0 | — | 50 | 24 | 2-30 |
| OP224 | Pill, lensed | GaAlAs | 3.5 | — | 50 | 24 | 2-30 |
| OP231 | TO-46, lensed | GaAlAs | 1.5 | — | 100 | 18 | 2-32 |
| OP231W | TO-46 | GaAlAs | 1.5 | — | 100 | 50 | 2-34 |
| OP232 | TO-46, lensed | GaAlAs | 2.0 | 6.0 | 100 | 18 | 2-32 |
| OP232W | TO-46 | GaAlAs | 3.5 | 7.0 | 100 | 50 | 2-34 |
| OP233 | TO-46, lensed | GaAlAs | 3.0 | — | 100 | 18 | 2-32 |

*mW
Wavelength at peak emission is GaAs = 935nm, GaAlAs = 890nm

## Infrared-Light Emitting Diodes (IRED's)(cont)

| Part No. | Case Style | Type | Output Power $E_{e(APT)}$ ($mW/cm^2$) Min | Output Power $E_{e(APT)}$ ($mW/cm^2$) Max | Test Conditions $I_F$(mA) | Beam Angle (Deg.) | Page No. |
|---|---|---|---|---|---|---|---|
| OP240A | Plastic lateral | GaAlAs | 0.60 | — | 20 | 40 | 2-36 |
| OP240B | Plastic lateral | GaAlAs | 0.40 | 1.20 | 20 | 40 | 2-36 |
| OP240C | Plastic lateral | GaAlAs | 0.20 | 0.86 | 20 | 40 | 2-36 |
| OP240D | Plastic lateral | GaAlAs | 0.05 | — | 20 | 40 | 2-36 |
| OP245A | Plastic lateral | GaAlAs | 0.60 | — | 20 | 40 | 2-38 |
| OP245B | Plastic lateral | GaAlAs | 0.40 | 1.20 | 20 | 40 | 2-38 |
| OP245C | Plastic lateral | GaAlAs | 0.20 | 0.86 | 20 | 40 | 2-38 |
| OP245D | Plastic lateral | GaAlAs | 0.05 | — | 20 | 40 | 2-38 |
| OP265A | Plastic T-1 | GaAlAs | 2.70 | — | 20 | 18 | 2-40 |
| OP265B | Plastic T-1 | GaAlAs | 1.65 | 4.70 | 20 | 18 | 2-40 |
| OP265C | Plastic T-1 | GaAlAs | 0.54 | 3.30 | 20 | 18 | 2-40 |
| OP265D | Plastic T-1 | GaAlAs | 0.54 | — | 20 | 18 | 2-40 |
| OP265W | Plastic T-1 | GaAlAs | 1.0* | — | 20 | 90 | 2-42 |
| OP266A | Plastic T-1 | GaAlAs | 2.70 | — | 20 | 18 | 2-44 |
| OP266B | Plastic T-1 | GaAlAs | 1.65 | 4.70 | 20 | 18 | 2-44 |
| OP266C | Plastic T-1 | GaAlAs | 0.54 | 3.30 | 20 | 18 | 2-44 |
| OP266D | Plastic T-1 | GaAlAs | 0.54 | — | 20 | 18 | 2-44 |
| OP266W | Plastic T-1 | GaAlAs | 1.0* | — | 20 | 90 | 2-46 |
| OP268FA | Plastic end-looker | GaAlAs | 0.64 | — | 20 | 104 | 2-48 |
| OP268FB | Plastic end-looker | GaAlAs | 0.45 | 0.99 | 20 | 104 | 2-48 |
| OP268FC | Plastic end-looker | GaAlAs | 0.36 | — | 20 | 104 | 2-48 |
| OP269A | Plastic end-looker | GaAlAs | 0.58 | — | 20 | 46 | 2-50 |
| OP269B | Plastic end-looker | GaAlAs | 0.42 | 0.82 | 20 | 46 | 2-50 |
| OP269C | Plastic end-looker | GaAlAs | 0.34 | — | 20 | 46 | 2-50 |
| OP290A | Plastic T- 1 3/4 | GaAlAs | 210 | — | 1500 | 50 | 2-52 |
| OP290B | Plastic T- 1 3/4 | GaAlAs | 180 | 300 | 1500 | 50 | 2-52 |
| OP290C | Plastic T- 1 3/4 | GaAlAs | 150 | — | 1500 | 50 | 2-52 |
| OP291A | Plastic T- 1 3/4 | GaAlAs | 16.0 | — | 100 | 50 | 2-52 |
| OP291B | Plastic T- 1 3/4 | GaAlAs | 13.0 | 26.0 | 100 | 50 | 2-52 |
| OP291C | Plastic T- 1 3/4 | GaAlAs | 10.0 | — | 100 | 50 | 2-52 |
| OP292A | Plastic T- 1 3/4 | GaAlAs | 2.7 | — | 20 | 50 | 2-52 |
| OP292B | Plastic T- 1 3/4 | GaAlAs | 2.2 | 4.4 | 20 | 50 | 2-52 |
| OP292C | Plastic T- 1 3/4 | GaAlAs | 1.7 | — | 20 | 50 | 2-52 |
| OP293A | Plastic TO-18 | GaAlAs | 16.0 | — | 100 | 60 | 2-56 |
| OP293B | Plastic TO-18 | GaAlAs | 13.0 | 26.0 | 100 | 60 | 2-56 |
| OP293C | Plastic TO-18 | GaAlAs | 10.0 | — | 100 | 60 | 2-56 |
| OP294 | Plastic T-1 3/4 | GaAlAs | 0.5 | 1.5 | 5 | 50 | 2-60 |
| OP295A | Plastic T-1 3/4 | GaAlAs | 44.0 | — | 1500 | 20 | 2-62 |
| OP295B | Plastic T-1 3/4 | GaAlAs | 33.0 | 77.0 | 1500 | 20 | 2-62 |
| OP295C | Plastic T-1 3/4 | GaAlAs | 22.0 | — | 1500 | 20 | 2-62 |
| OP296A | Plastic T-1 3/4 | GaAlAs | 3.6 | — | 100 | 20 | 2-62 |
| OP296B | Plastic T-1 3/4 | GaAlAs | 2.6 | 6.6 | 100 | 20 | 2-62 |
| OP296C | Plastic T-1 3/4 | GaAlAs | 1.6 | — | 100 | 20 | 2-62 |

*mW
Wavelength at peak emission is GaAs = 935nm, GaAlAs = 890nm

## Infrared-Light Emitting Diodes (IRED's)(cont)

| Part No. | Case Style | Type | Output Power $E_{e(APT)}$ (mW/cm²) Min | Max | Test Conditions $I_F$(mA) | Beam Angle (Deg.) | Page No. |
|---|---|---|---|---|---|---|---|
| OP297A | Plastic T-1 3/4 | GaAlAs | 0.7 | — | 20 | 20 | 2-62 |
| OP297B | Plastic T-1 3/4 | GaAlAs | 0.5 | 1.3 | 20 | 20 | 2-62 |
| OP297C | Plastic T-1 3/4 | GaAlAs | 0.3 | — | 20 | 20 | 2-62 |
| OP298A | Plastic TO-18 | GaAlAs | 3.0 | — | 100 | 25 | 2-56 |
| OP298B | Plastic TO-18 | GaAlAs | 2.4 | 4.8 | 100 | 25 | 2-56 |
| OP298C | Plastic TO-18 | GaAlAs | 1.8 | — | 100 | 25 | 2-56 |
| OP299 | Plastic T-1 3/4 | GaAlAs | 0.15 | 0.45 | 5 | 20 | 2-60 |

*mW
Wavelength at peak emission is GaAs = 935nm, GaAlAs = 890nm
Consult product catalog for full test and electrical specifications

## Photosensors

| Part No. | Case Style | Light Current $I_{C(ON)}$ (mA) Min | Max | Test Conditions $V_{CE}$ | $E_e$(mW/cm²) | Beam Angle (Deg.) | Page No. |
|---|---|---|---|---|---|---|---|
| OP300SL(1) | Pill, lensed | 0.8 | — | 5.0 | 1.0 | 35 | 3-4 |
| OP301SL(1) | Pill, lensed | 0.8 | 2.4 | 5.0 | 1.0 | 35 | 3-4 |
| OP302SL(1) | Pill, lensed | 1.8 | 5.4 | 5.0 | 1.0 | 35 | 3-4 |
| OP303SL(1) | Pill, lensed | 3.6 | 12.0 | 5.0 | 1.0 | 35 | 3-4 |
| OP304SL(1) | Pill, lensed | 7.0 | 21.0 | 5.0 | 1.0 | 35 | 3-4 |
| OP305SL(1) | Pill, lensed | 14.0 | — | 5.0 | 1.0 | 35 | 3-4 |
| OP505A | Plastic T-1 | 4.30 | — | 5.0 | 0.50 | 18 | 3-6 |
| OP505B | Plastic T-1 | 2.15 | 5.95 | 5.0 | 0.50 | 18 | 3-6 |
| OP505C | Plastic T-1 | 1.10 | 3.00 | 5.0 | 0.50 | 18 | 3-6 |
| OP505D | Plastic T-1 | 0.55 | — | 5.0 | 0.50 | 18 | 3-6 |
| OP505W | Plastic T-1 | 0.10 | — | 5.0 | 0.75 | 90 | 3-8 |
| OP506A | Plastic T-1 | 4.30 | — | 5.0 | 0.50 | 18 | 3-10 |
| OP506B | Plastic T-1 | 2.15 | 5.95 | 5.0 | 0.50 | 18 | 3-10 |
| OP506C | Plastic T-1 | 1.10 | 3.00 | 5.0 | 0.50 | 18 | 3-10 |
| OP506D | Plastic T-1 | 0.55 | — | 5.0 | 0.50 | 18 | 3-10 |
| OP506W | Plastic T-1 | 0.10 | — | 5.0 | 0.75 | 90 | 3-12 |
| OP508FA | Plastic end-looker | 2.70 | — | 5.0 | 5.0 | 120 | 3-14 |
| OP508FB | Plastic end-looker | 0.65 | 5.10 | 5.0 | 5.0 | 120 | 3-14 |
| OP508FC | Plastic end-looker | 0.34 | — | 5.0 | 5.0 | 120 | 3-14 |
| OP509A | Plastic end-looker | 5.7 | — | 5.0 | 5.0 | 50 | 3-16 |
| OP509B | Plastic end-looker | 1.4 | 10.6 | 5.0 | 5.0 | 50 | 3-16 |
| OP509C | Plastic end-looker | 0.7 | — | 5.0 | 5.0 | 50 | 3-16 |
| OP535A(1) | Plastic T-1 | 10.5 | — | 5.0 | 0.13 | 18 | 3-18 |
| OP535B | Plastic T-1 | 3.5 | 32.0 | 5.0 | 0.13 | 18 | 3-18 |
| OP535C | Plastic T-1 | 1.5 | — | 5.0 | 0.13 | 18 | 3-18 |

(1) Photodarlington
(2) Photodiode
All others are phototransistors
Part numbers with "SL" suffix are tested using Tungsten light source @ 2870K
All others are tested with an infrared LED light source

## Photosensors (cont)

| Part No. | Case Style | Light Current $I_{C(ON)}$ (mA) Min | Max | Test Conditions $V_{CE}$ | $E_e$(mW/cm$^2$) | Beam Angle (Deg.) | Page No. |
|---|---|---|---|---|---|---|---|
| OP538FA(1) | Plastic end-looker | 6.8 | — | 5.0 | 0.50 | 120 | 3-20 |
| OP538FB(1) | Plastic end-looker | 2.3 | 20.5 | 5.0 | 0.50 | 120 | 3-20 |
| OP538FC(1) | Plastic end-looker | 1.1 | — | 5.0 | 0.50 | 120 | 3-20 |
| OP550A | Plastic lateral | 2.55 | — | 5.0 | 1.0 | 60 | 3-22 |
| OP550B | Plastic lateral | 1.30 | 4.70 | 5.0 | 1.0 | 60 | 3-22 |
| OP550C | Plastic lateral | 0.25 | 2.40 | 5.0 | 1.0 | 60 | 3-22 |
| OP550D | Plastic lateral | 0.25 | — | 5.0 | 1.0 | 60 | 3-22 |
| OP555A | Plastic lateral | 2.55 | — | 5.0 | 1.0 | 60 | 3-24 |
| OP555B | Plastic lateral | 1.30 | 4.70 | 5.0 | 1.0 | 60 | 3-24 |
| OP555C | Plastic lateral | 0.25 | 2.40 | 5.0 | 1.0 | 60 | 3-24 |
| OP555D | Plastic lateral | 0.25 | — | 5.0 | 1.0 | 60 | 3-24 |
| OP560A(1) | Plastic T-1 | 6.6 | — | 2.0 | 0.1 | 60 | 3-26 |
| OP560B(1) | Plastic T-1 | 3.3 | 9.8 | 2.0 | 0.1 | 60 | 3-26 |
| OP560C(1) | Plastic T-1 | 1.1 | — | 2.0 | 0.1 | 60 | 3-26 |
| OP565A(1) | Plastic T-1 | 6.6 | — | 2.0 | 0.1 | 60 | 3-28 |
| OP565B(1) | Plastic T-1 | 3.3 | 9.8 | 2.0 | 0.1 | 60 | 3-28 |
| OP565C(1) | Plastic T-1 | 1.1 | — | 2.0 | 0.1 | 60 | 3-28 |
| OP593A | Plastic TO-18 | 3.0 | — | 5.0 | 1.7 | 130 | 3-30 |
| OP593B | Plastic TO-18 | 2.0 | 4.0 | 5.0 | 1.7 | 130 | 3-30 |
| OP593C | Plastic TO-18 | 1.0 | — | 5.0 | 1.7 | 130 | 3-30 |
| OP598A | Plastic TO-18 | 7.5 | — | 5.0 | 1.7 | 25 | 3-30 |
| OP598B | Plastic TO-18 | 5.0 | 10.0 | 5.0 | 1.7 | 25 | 3-30 |
| OP598C | Plastic TO-18 | 2.5 | — | 5.0 | 1.7 | 25 | 3-30 |
| OP599A | Plastic T 1 3/4 | 2.35 | — | 5.0 | 0.25 | 20 | 3-34 |
| OP599B | Plastic T 1 3/4 | 1.20 | 3.85 | 5.0 | 0.25 | 20 | 3-34 |
| OP599C | Plastic T 1 3/4 | 0.40 | 1.95 | 5.0 | 0.25 | 20 | 3-34 |
| OP599D | Plastic T 1 3/4 | 0.20 | — | 5.0 | 0.25 | 20 | 3-34 |
| OP600A | Pill, lensed | 1.2 | — | 5.0 | 2.5 | 35 | 3-36 |
| OP600B | Pill, lensed | 0.6 | 1.8 | 5.0 | 2.5 | 35 | 3-36 |
| OP600C | Pill, lensed | 0.3 | — | 5.0 | 2.5 | 35 | 3-36 |
| OP641SL | Pill, lensed | 0.5 | 3.0 | 5.0 | 20.0 | 35 | 3-38 |
| OP642SL | Pill, lensed | 2.0 | 5.0 | 5.0 | 20.0 | 35 | 3-38 |
| OP643SL | Pill, lensed | 4.0 | 8.0 | 5.0 | 20.0 | 35 | 3-38 |
| OP644SL | Pill, lensed | 7.0 | 22.0 | 5.0 | 20.0 | 35 | 3-38 |
| OP800A | TO-18, lensed | 3.60 | — | 5.0 | 0.5 | 25 | 3-40 |
| OP800B | TO-18, lensed | 1.80 | 5.40 | 5.0 | 0.5 | 25 | 3-40 |
| OP800C | TO-18, lensed | 0.90 | 3.60 | 5.0 | 0.5 | 25 | 3-40 |
| OP800D | TO-18, lensed | 0.45 | — | 5.0 | 0.5 | 25 | 3-40 |
| OP800SL | TO-18, lensed | 0.5 | — | 5.0 | 5.0 | 25 | 3-42 |
| OP800WSL | TO-18 | 0.3 | — | 5.0 | 5.0 | 75 | 3-44 |
| OP801SL | TO-18, lensed | 0.5 | 3.0 | 5.0 | 5.0 | 25 | 3-42 |
| OP801WSL | TO-18 | 0.5 | 3.0 | 5.0 | 5.0 | 75 | 3-44 |
| OP802SL | TO-18, lensed | 2.0 | 5.0 | 5.0 | 5.0 | 25 | 3-42 |
| OP802WSL | TO-18 | 2.5 | — | 5.0 | 5.0 | 75 | 3-44 |

(1) Photodarlington
(2) Photodiode
All others are phototransistors
Part numbers with "SL" suffix are tested using Tungsten light source @ 2870K
All others are tested with an infrared LED light source

## Photosensors (cont)

| Part No. | Case Style | Light Current $I_{C(ON)}$ (mA) Min | Max | Test Conditions $V_{CE}$ | $E_e$(mW/cm$^2$) | Beam Angle (Deg.) | Page No. |
|---|---|---|---|---|---|---|---|
| OP803SL | TO-18, lensed | 4.0 | 8.0 | 5.0 | 5.0 | 25 | 3-42 |
| OP804SL | TO-18, lensed | 7.0 | 22.0 | 5.0 | 5.0 | 25 | 3-42 |
| OP805SL | TO-18, lensed | 15.0 | — | 5.0 | 5.0 | 25 | 3-42 |
| OP830SL(1) | TO-18, lensed | 15.0 | — | 5.0 | 0.5 | 25 | 3-46 |
| OP830WSL(1) | TO-18 | 4.0 | — | 5.0 | 0.5 | 75 | 3-48 |
| OP900SL(2) | Pill, lensed | 8.0 | — | 10.0 | 20.0 | 35 | 3-50 |
| OP913SL(2) | TO-5, lensed | 0.12 | — | 5.0 | 5.0 | 20 | 3-52 |
| OP913WSL(2) | TO-5 | 0.04 | — | 5.0 | 5.0 | 60 | 3-52 |

(1) Photodarlington
(2) Photodiode
All others are phototransistors
Part numbers with "SL" suffix are tested using Tungsten light source @ 2870K
All others are tested with an infrared LED light source

## Photologic™ Sensors

| Part No. | Case Style | Positive Threshold Irradiance* $E_eT(+)$ (mW/cm$^2$) Min | Max | Output Circuit | Page No. |
|---|---|---|---|---|---|
| OPL550 | Plastic lateral | 0.25 | 2.4 | Totem-Pole Buffer | 4-4 |
| OPL550A | Plastic lateral | 0.25 | 1.4 | Totem-Pole Buffer | 4-4 |
| OPL550B | Plastic lateral | 0.65 | 1.9 | Totem-Pole Buffer | 4-4 |
| OPL550-OC | Plastic lateral | 0.25 | 2.4 | Open-Collector Buffer | 4-4 |
| OPL550-OCA | Plastic lateral | 0.25 | 1.4 | Open-Collector Buffer | 4-4 |
| OPL550-OCB | Plastic lateral | 0.65 | 1.9 | Open-Collector Buffer | 4-4 |
| OPL551 | Plastic lateral | 0.25 | 2.4 | Totem-Pole Inverter | 4-4 |
| OPL551A | Plastic lateral | 0.25 | 1.4 | Totem-Pole Inverter | 4-4 |
| OPL551B | Plastic lateral | 0.65 | 1.9 | Totem-Pole Inverter | 4-4 |
| OPL551-OC | Plastic lateral | 0.25 | 2.4 | Open-Collector Inverter | 4-4 |
| OPL551-OCA | Plastic lateral | 0.25 | 1.4 | Open-Collector Inverter | 4-4 |
| OPL551-OCB | Plastic lateral | 0.65 | 1.9 | Open-Collector Inverter | 4-4 |
| OPL560 | Plastic lateral | 0.09 | 0.55 | Totem-Pole Buffer | 4-8 |
| OPL560A | Plastic lateral | 0.09 | 0.36 | Totem-Pole Buffer | 4-8 |
| OPL560B | Plastic lateral | 0.18 | 0.55 | Totem-Pole Buffer | 4-8 |
| OPL560-OC | Plastic lateral | 0.09 | 0.55 | Open-Collector Buffer | 4-8 |
| OPL560-OCA | Plastic lateral | 0.09 | 0.36 | Open-Collector Buffer | 4-8 |
| OPL560-OCB | Plastic lateral | 0.18 | 0.55 | Open-Collector Buffer | 4-8 |
| OPL561 | Plastic lateral | 0.09 | 0.55 | Totem-Pole Inverter | 4-8 |
| OPL561A | Plastic lateral | 0.09 | 0.36 | Totem-Pole Inverter | 4-8 |
| OPL561B | Plastic lateral | 0.18 | 0.55 | Totem-Pole Inverter | 4-8 |
| OPL561-OC | Plastic lateral | 0.09 | 0.55 | Open-Collector Inverter | 4-8 |
| OPL561-OCA | Plastic lateral | 0.09 | 0.36 | Open-Collector Inverter | 4-8 |
| OPL561-OCB | Plastic lateral | 0.18 | 0.55 | Open-Collector Inverter | 4-8 |
| OPL562 | Plastic lateral | 0.025 | 0.23 | Totem-Pole Buffer | 4-8 |
| OPL562A | Plastic lateral | 0.025 | 0.14 | Totem-Pole Buffer | 4-8 |
| OPL562B | Plastic lateral | 0.070 | 0.23 | Totem-Pole Buffer | 4-8 |

* $\lambda_i$ = 935nm Note: The OPL560 & OPL810 series include a voltage regulator allowing operating voltages from 4.5 to 16.0 volts.

## Photologic™ Sensors (cont)

| Part No. | Case Style | Positive Threshold Irradiance* $E_eT(+)$ ($mW/cm^2$) Min | Max | Output Circuit | Page No. |
|---|---|---|---|---|---|
| OPL562-OC | Plastic lateral | 0.025 | 0.23 | Open-Collector Buffer | 4-8 |
| OPL562-OCA | Plastic lateral | 0.025 | 0.14 | Open-Collector Buffer | 4-8 |
| OPL562-OCB | Plastic lateral | 0.070 | 0.23 | Open-Collector Buffer | 4-8 |
| OPL563 | Plastic lateral | 0.025 | 0.23 | Totem-Pole Inverter | 4-8 |
| OPL563A | Plastic lateral | 0.025 | 0.14 | Totem-Pole Inverter | 4-8 |
| OPL563B | Plastic lateral | 0.070 | 0.23 | Totem-Pole Inverter | 4-8 |
| OPL563-OC | Plastic lateral | 0.025 | 0.23 | Open-Collector Inverter | 4-8 |
| OPL563-OCA | Plastic lateral | 0.025 | 0.14 | Open-Collector Inverter | 4-8 |
| OPL563-OCB | Plastic lateral | 0.070 | 0.23 | Open-Collector Inverter | 4-8 |
| OPL583 | Plastic lateral | 0.050 | 0.25 | Dual Channel | 4-12 |
| OPL800 | TO-18, lensed | 0.05 | 0.60 | Totem-Pole Buffer | 4-16 |
| OPL800-OC | TO-18, lensed | 0.05 | 0.60 | Open-Collector Buffer | 4-16 |
| OPL801 | TO-18, lensed | 0.05 | 0.60 | Totem-Pole Inverter | 4-16 |
| OPL801-OC | TO-18, lensed | 0.05 | 0.60 | Open-Collector Inverter | 4-16 |
| OPL810 | TO-18, lensed | 0.015 | 0.20 | Totem-Pole Buffer | 4-20 |
| OPL810-OC | TO-18, lensed | 0.015 | 0.20 | Open-Collector Buffer | 4-20 |
| OPL811 | TO-18, lensed | 0.015 | 0.20 | Totem-Pole Inverter | 4-20 |
| OPL811-OC | TO-18, lensed | 0.015 | 0.20 | Open-Collector Inverter | 4-20 |
| OPL812 | TO-18, lensed | 0.005 | 0.10 | Totem-Pole Buffer | 4-20 |
| OPL812-OC | TO-18, lensed | 0.005 | 0.10 | Open-Collector Buffer | 4-20 |
| OPL813 | TO-18, lensed | 0.005 | 0.10 | Totem-Pole Inverter | 4-20 |
| OPL813-OC | TO-18, lensed | 0.005 | 0.10 | Open-Collector Inverter | 4-20 |

* $\lambda_i$ = 935nm Note: The OPL560 & OPL810 series include a voltage regulator allowing operating voltages from 4.5 to 16.0 volts.

## Emitter and Photosensor Matched Pairs

| Part No. | Case Style | Light Current $I_{C(ON)}$ mA Min | Max | Test Conditions $V_{CE}$ | $I_F$ (mA) | Page No. |
|---|---|---|---|---|---|---|
| OPS665 | Plastic T-1 | 0.5 | — | 5.0 | 20 | 5-2 |
| OPS666 | Plastic T-1 | 1.0 | 10.0 | 5.0 | 20 | 5-2 |
| OPS667 | Plastic T-1 | 5.0 | — | 5.0 | 20 | 5-2 |
| OPS690 | Plastic lateral | 100* | — | 10.0 | 20 | 5-4 |
| OPS691 | Plastic lateral | 500* | — | 10.0 | 20 | 5-4 |
| OPS692 | Plastic lateral | 1.0 | — | 10.0 | 20 | 5-4 |
| OPS693 | Plastic lateral | 2.0 | — | 10.0 | 20 | 5-4 |
| OPS695 | Plastic lateral | 100* | — | 10.0 | 20 | 5-6 |
| OPS696 | Plastic lateral | 500* | — | 10.0 | 20 | 5-6 |
| OPS697 | Plastic lateral | 1.0 | — | 10.0 | 20 | 5-6 |
| OPS698 | Plastic lateral | 2.0 | — | 10.0 | 20 | 5-6 |

* µA

## Optically Coupled Isolators

| Part No. | Case Style | CTR % Min | CTR % Max | $V_{CE}$ | $I_F$ mA | Isolation kVDC | Page No. |
|---|---|---|---|---|---|---|---|
| OPI110 | Plastic Axial | 12.5 | — | 5.0 | 10.0 | 10.0 | 6-4 |
| OPI110A | Plastic Axial | 25.0 | — | 5.0 | 10.0 | 10.0 | 6-4 |
| OPI110B | Plastic Axial | 50.0 | 125 | 5.0 | 10.0 | 10.0 | 6-4 |
| OPI110C | Plastic Axial | 100.0 | — | 5.0 | 10.0 | 10.0 | 6-4 |
| OPI113 | Plastic Axial | 50.0 | — | 2.0 | 5.0 | 10.0 | 6-4 |
| OPI120 | Hermetic Axial | 20.0 | — | 5.0 | 10.0 | 15.0 | 6-6 |
| OPI123 | Hermetic Axial | 50.0 | — | 2.0 | 10.0 | 15.0 | 6-6 |
| OPI125 | Hermetic Axial | Buffer, Totem Pole | | | | 15.0 | 6-8 |
| OPI126 | Hermetic Axial | Buffer, Open-Collector | | | | 15.0 | 6-8 |
| OPI127 | Hermetic Axial | Inverter, Totem-Pole | | | | 15.0 | 6-8 |
| OPI128 | Hermetic Axial | Inverter, Open-Collector | | | | 15.0 | 6-8 |
| OPI1264 | Plastic Axial | 12.5 | — | 5.0 | 10.0 | 10.0 | 6-12 |
| OPI1264A | Plastic Axial | 25.0 | — | 5.0 | 10.0 | 10.0 | 6-12 |
| OPI1264B | Plastic Axial | 50.0 | 125 | 5.0 | 10.0 | 10.0 | 6-12 |
| OPI1264C | Plastic Axial | 100.0 | — | 5.0 | 10.0 | 10.0 | 6-12 |
| OPI1266 | Custom Dip | High Speed Photologic | | | | 16.0 | 6-14 |
| OPI150 | Hermetic Axial | 10.0 | — | 5.0 | 10.0 | 50.0 | 6-16 |
| OPI153 | Hermetic Axial | 25.0 | — | 5.0 | 20.0 | 50.0 | 6-16 |
| OPI7002 | Custom Dip | 20.0 | — | 5.0 | 10.0 | 6.0 | 6-18 |
| OPI7010 | Custom Dip | 100.0 | — | 5.0 | 10.0 | 6.0 | 6-18 |
| OPI7320 | Custom Dip | 200.0 | — | 5.0 | 5.0 | 6.0 | 6-20 |
| OPI7340 | Custom Dip | 400.0 | — | 5.0 | 5.0 | 6.0 | 6-20 |

## Fiber Optics PIN Photodiodes & Receivers

| Part No. | Case Style | Flux Responsivity (A/W) Min | Flux Responsivity (A/W) Typ | Output Rise Time (ns) Typ | Page No. |
|---|---|---|---|---|---|
| OPF2404 | Plastic Dip | 5.1(1) | 7.0 | 14.0 | 8-6 |
| OPF2406 | Plastic Dip | 5.0(1) | 7.0 | 3.3 | 8-8 |
| OPF2414 | Plastic Dip | 5.1(1) | 7.0 | 14.0 | 8-6 |
| OPF2416 | Plastic Dip | 5.0(1) | 7.0 | 3.3 | 8-8 |
| OPF420 | Hermetic TO-46 | 0.45 | 0.55 | 6.0 | 8-46 |
| OPF421 | SMA | 0.45 | 0.55 | 6.0 | 8-48 |
| OPF422 | ST(2) | 0.45 | 0.55 | 6.0 | 8-50 |
| OPF430 | Hermetic TO-46 | 0.45 | 0.55 | 1.0 | 8-52 |
| OPF431 | SMA | 0.45 | 0.55 | 1.0 | 8-54 |
| OPF432 | ST(2) | 0.45 | 0.55 | 1.0 | 8-56 |
| OPF470 | Plastic TO-46 | 0.45 | 0.55 | 6.0 | 8-58 |
| OPF471 | SMA | 0.45 | 0.55 | 6.0 | 8-60 |
| OPF472 | ST(2) | 0.45 | 0.55 | 6.0 | 8-62 |
| OPF480 | Plastic TO-46 | 0.45 | 0.55 | 1.0 | 8-64 |
| OPF481 | SMA | 0.45 | 0.55 | 1.0 | 8-66 |
| OPF482 | ST(2) | 0.45 | 0.55 | 1.0 | 8-68 |
| OPF540 | Plastic TO-46 | 5.1(1) | 7.0 | 14.0 | 8-70 |
| OPF541 | SMA | 5.1(1) | 7.0 | 14.0 | 8-72 |
| OPF542 | ST(2) | 5.1(1) | 7.0 | 14.0 | 8-74 |

(1) mV/μW

# Fiber Optics (850nm) Light Emitting Diodes

| Part No. | Case Style | Radiant Output[3] Power (µW) Min | Typ | Test Conditions $I_F$ (mA) | | Output Rise Time (ns) Typ | Page No. |
|---|---|---|---|---|---|---|---|
| OPF1402 | Plastic Dip | -19.0 dBm | -16.0 dBm | 60 | (62.5µm core) | 4.0 | 8-4 |
| OPF1404 | Plastic Dip | -15.0 dBm | -12.0 dBm | 60 | (62.5µm core) | 4.0 | 8-4 |
| OPF1412 | Plastic Dip | -19.0 dBm | -16.0 dBm | 60 | (62.5µm core) | 4.0 | 8-4 |
| OPF1414 | Plastic Dip | -15.0 dBm | -12.0 dBm | 60 | (62.5µm core) | 4.0 | 8-4 |
| OPF320A | Hermetic TO-46 | 15.0 | 19.0 | 100 | (50 µm core) | 6.0 | 8-10 |
| OPF320B | Hermetic TO-46 | 10.0 | 12.5 | 100 | (50 µm core) | 6.0 | 8-10 |
| OPF320C | Hermetic TO-46 | 5.0 | 7.5 | 100 | (50 µm core) | 6.0 | 8-10 |
| OPF321A | SMA | 15.0 | 19.0 | 100 | (50 µm core) | 6.0 | 8-12 |
| OPF321B | SMA | 10.0 | 12.5 | 100 | (50 µm core) | 6.0 | 8-12 |
| OPF321C | SMA | 5.0 | 7.5 | 100 | (50 µm core) | 6.0 | 8-12 |
| OPF322A | ST[2] | 15.0 | 19.0 | 100 | (50 µm core) | 6.0 | 8-14 |
| OPF322B | ST[2] | 10.0 | 12.5 | 100 | (50 µm core) | 6.0 | 8-14 |
| OPF322C | ST[2] | 5.0 | 7.5 | 100 | (50 µm core) | 6.0 | 8-14 |
| OPF340A | Hermetic TO-46 | 20.0 | 25.0 | 100 | (50 µm core) | 4.5 | 8-16 |
| OPF340B | Hermetic TO-46 | 15.0 | 18.0 | 100 | (50 µm core) | 4.5 | 8-16 |
| OPF340C | Hermetic TO-46 | 10.0 | 12.5 | 100 | (50 µm core) | 4.5 | 8-16 |
| OPF340D | Hermetic TO-46 | 5.0 | 7.5 | 100 | (50 µm core) | 4.5 | 8-16 |
| OPF341A | SMA | 20.0 | 25.0 | 100 | (50 µm core) | 4.5 | 8-18 |
| OPF341B | SMA | 15.0 | 18.0 | 100 | (50 µm core) | 4.5 | 8-18 |
| OPF341C | SMA | 10.0 | 12.5 | 100 | (50 µm core) | 4.5 | 8-18 |
| OPF341D | SMA | 5.0 | 7.5 | 100 | (50 µm core) | 4.5 | 8-18 |
| OPF342A | ST[2] | 20.0 | 25.0 | 100 | (50 µm core) | 4.5 | 8-20 |
| OPF342B | ST[2] | 15.0 | 18.0 | 100 | (50 µm core) | 4.5 | 8-20 |
| OPF342C | ST[2] | 10.0 | 12.5 | 100 | (50 µm core) | 4.5 | 8-20 |
| OPF342D | ST[2] | 5.0 | 7.5 | 100 | (50 µm core) | 4.5 | 8-20 |
| OPF345A | Hermetic TO-46 | 20.0 | 25.0 | 100 | (50 µm core) | 3.5 | 8-22 |
| OPF345B | Hermetic TO-46 | 15.0 | 18.0 | 100 | (50 µm core) | 3.5 | 8-22 |
| OPF345C | Hermetic TO-46 | 10.0 | 12.5 | 100 | (50 µm core) | 3.5 | 8-22 |
| OPF345D | Hermetic TO-46 | 5.0 | 7.5 | 100 | (50 µm core) | 3.5 | 8-22 |
| OPF346A | SMA | 20.0 | 25.0 | 100 | (50 µm core) | 3.5 | 8-24 |
| OPF346B | SMA | 15.0 | 18.0 | 100 | (50 µm core) | 3.5 | 8-24 |
| OPF346C | SMA | 10.0 | 12.5 | 100 | (50 µm core) | 3.5 | 8-24 |
| OPF346D | SMA | 5.0 | 7.5 | 100 | (50 µm core) | 3.5 | 8-24 |
| OPF347A | ST[2] | 20.0 | 25.0 | 100 | (50 µm core) | 3.5 | 8-26 |
| OPF347B | ST[2] | 15.0 | 18.0 | 100 | (50 µm core) | 3.5 | 8-26 |
| OPF347C | ST[2] | 10.0 | 12.5 | 100 | (50 µm core) | 3.5 | 8-26 |
| OPF347D | ST[2] | 5.0 | 7.5 | 100 | (50 µm core) | 3.5 | 8-26 |
| OPF370A | Plastic TO-46 | 25.0 | 29.0 | 100 | (50 µm core) | 6.0 | 8-28 |
| OPF370B | Plastic TO-46 | 15.0 | 19.0 | 100 | (50 µm core) | 6.0 | 8-28 |
| OPF370C | Plastic TO-46 | 10.0 | 12.5 | 100 | (50 µm core) | 6.0 | 8-28 |
| OPF370D | Plastic TO-46 | 5.0 | 7.5 | 100 | (50 µm core) | 6.0 | 8-28 |

(2) ST is a registered trademark of AT&T
(3) Fiber Optic components tested with graded index fiber 50µM core: NA = 0.20

# Fiber Optics (850nm) Light Emitting Diodes (cont)



| Part No. | Case Style | Radiant Output[3] Power (μW) Min | Typ | Test Conditions $I_F$ (mA) | Output Rise Time (ns) Typ | Page No. |
|---|---|---|---|---|---|---|
| OPF371A | SMA | 25.0 | 29.0 | 100 (50 μm core) | 6.0 | 8-30 |
| OPF371B | SMA | 15.0 | 19.0 | 100 (50 μm core) | 6.0 | 8-30 |
| OPF371C | SMA | 10.0 | 12.5 | 100 (50 μm core) | 6.0 | 8-30 |
| OPF371D | SMA | 5.0 | 7.5 | 100 (50 μm core) | 6.0 | 8-30 |
| OPF372A | ST[2] | 25.0 | 29.0 | 100 (50 μm core) | 6.0 | 8-32 |
| OPF372B | ST[2] | 15.0 | 19.0 | 100 (50 μm core) | 6.0 | 8-32 |
| OPF372C | ST[2] | 10.0 | 12.5 | 100 (50 μm core) | 6.0 | 8-32 |
| OPF372D | ST[2] | 5.0 | 7.5 | 100 (50 μm core) | 6.0 | 8-32 |
| OPF390A | Plastic TO-46 | 20.0 | 25.0 | 100 (50 μm core) | 4.5 | 8-34 |
| OPF390B | Plastic TO-46 | 15.0 | 18.0 | 100 (50 μm core) | 4.5 | 8-34 |
| OPF390C | Plastic TO-46 | 10.0 | 12.5 | 100 (50 μm core) | 4.5 | 8-34 |
| OPF390D | Plastic TO-46 | 5.0 | 7.5 | 100 (50 μm core) | 4.5 | 8-34 |
| OPF391A | SMA | 20.0 | 25.0 | 100 (50 μm core) | 4.5 | 8-36 |
| OPF391B | SMA | 15.0 | 18.0 | 100 (50 μm core) | 4.5 | 8-36 |
| OPF391C | SMA | 10.0 | 12.5 | 100 (50 μm core) | 4.5 | 8-36 |
| OPF391D | SMA | 5.0 | 7.5 | 100 (50 μm core) | 4.5 | 8-36 |
| OPF392A | ST[2] | 20.0 | 25.0 | 100 (50 μm core) | 4.5 | 8-38 |
| OPF392B | ST[2] | 15.0 | 18.0 | 100 (50 μm core) | 4.5 | 8-38 |
| OPF392C | ST[2] | 10.0 | 12.5 | 100 (50 μm core) | 4.5 | 8-38 |
| OPF392D | ST[2] | 5.0 | 7.5 | 100 (50 μm core) | 4.5 | 8-38 |
| OPF395A | Plastic TO-46 | 20.0 | 25.0 | 100 (50 μm core) | 3.5 | 8-40 |
| OPF395B | Plastic TO-46 | 15.0 | 18.0 | 100 (50 μm core) | 3.5 | 8-40 |
| OPF395C | Plastic TO-46 | 10.0 | 12.5 | 100 (50 μm core) | 3.5 | 8-40 |
| OPF395D | Plastic TO-46 | 5.0 | 7.5 | 100 (50 μm core) | 3.5 | 8-40 |
| OPF396A | SMA | 20.0 | 25.0 | 100 (50 μm core) | 3.5 | 8-42 |
| OPF396B | SMA | 15.0 | 18.0 | 100 (50 μm core) | 3.5 | 8-42 |
| OPF396C | SMA | 10.0 | 12.5 | 100 (50 μm core) | 3.5 | 8-42 |
| OPF396D | SMA | 5.0 | 7.5 | 100 (50 μm core) | 3.5 | 8-42 |
| OPF397A | ST[2] | 20.0 | 25.0 | 100 (50 μm core) | 3.5 | 8-44 |
| OPF397B | ST[2] | 15.0 | 18.0 | 100 (50 μm core) | 3.5 | 8-44 |
| OPF397C | ST[2] | 10.0 | 12.5 | 100 (50 μm core) | 3.5 | 8-44 |
| OPF397D | ST[2] | 5.0 | 7.5 | 100 (50 μm core) | 3.5 | 8-44 |

(2) ST is a registered trademark of AT&T
(3) Fiber Optic components tested with graded index fiber 50μM core: NA = 0.20

## Hybrid Assemblies
## Infrared Emitting Diodes

| Part No. | Type | Output Power | Test Conditions $I_F$ (mA) | Case Style | Page No. |
|---|---|---|---|---|---|
| OPR5200 | GaAlAs | 350 µW (min) | 20 | Surface Mount | 9-22 |

## Phototransistor

| Part No. | Light Current | Test Conditions $V_{CE}$ (V) | Test Conditions $E_e$ (mW/cm$^2$) | Case Style | Page No. |
|---|---|---|---|---|---|
| OPR5500 | 36 µA (min) | 5 | .15 | Surface Mount | 9-23 |

## Photodiodes

| Part No. | Responsivity (A/W) | Test Conditions $\phi_e$ (µW) | Size (mm$^2$) | Case Style | Page No. |
|---|---|---|---|---|---|
| OPR2100 | 0.45 | 10 | 6 × 2.9 | Surface Mount | 9-16 |
| OPR5910 | 0.45 | 10 | 0.73 | Surface Mount | 9-24 |
| OPR5911 | 0.45 | 10 | 1.0 | Surface Mount | 9-25 |
| OPR5913 | 0.40 | 10 | 25 | Surface Mount | 9-26 |
| OPR5915 | 0.45 | 10 | 7.3 | Surface Mount | 9-27 |
| OPR5925 | 0.45 | 10 | 4 × 0.64 | Surface Mount | 9-28 |
| OPR5929 | 0.45 | 10 | 6 × 2.9 | Surface Mount | 9-29 |

## Optical Comparator Arrays

| Part No. | Icc (max) (mA) | Channels | Case Style | Page No. |
|---|---|---|---|---|
| OPR5001B | 7 | 1 | Surface Mount | 9-17 |
| OPR5002B | 14 | 2 | Surface Mount | 9-17 |
| OPR5003B | 20 | 3 | Surface Mount | 9-17 |

## Reflective Object Sensor

| Part No. | $I_{C(ON)}$ | Test Conditions $I_F$ (mA) | Test Conditions $V_{CE}$ (V) | Case Style | Page No. |
|---|---|---|---|---|---|
| OPR5005 | 100 µA (min) | 20 | 5 | Surface Mount | 9-20 |

## Hallogic™ Hall Effect Sensors

| Part No. | Operate Point Gauss | | | Release Point Gauss | | | Hysteresis Gauss | | | Case Style | Page No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | | |
| OH090U(1) | 0 | 90 | 180 | -100 | 65 | 100 | 10 | 25 | 100 | Plastic Lateral | 10-4 |
| OH180U(1) | 70 | 180 | 290 | 0 | 140 | 230 | 20 | 40 | 120 | Plastic Lateral | 10-6 |
| OH360U(1) | 235 | 300 | 465 | 120 | 235 | 325 | 30 | 65 | 200 | Plastic Lateral | 10-8 |
| OHN3013U(1) | | 300 | 450 | 25 | 235 | | 30 | 65 | | Plastic Lateral | 10-10 |
| OHN3019U(1) | | 300 | 500 | 125 | 235 | | 50 | 65 | | Plastic Lateral | 10-12 |
| OHS3019U(1) | | 300 | 500 | 125 | 235 | | 50 | 65 | | Plastic Lateral | 10-12 |
| OHN3020U(1) | | 230 | 350 | 50 | 180 | | 20 | 50 | | Plastic Lateral | 10-14 |
| OHS3020U(1) | | 230 | 350 | 50 | 180 | | 20 | 50 | | Plastic Lateral | 10-14 |

(1) $T_A = 25^\circ$ C

## Hallogic™ Hall Effect Sensors (cont)

| Part No. | Operate Point Gauss | | | Release Point Gauss | | | Hysteresis Gauss | | | Case Style | Page No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | | |
| OHN3030U[1] | | 205 | 250 | 0 | 160 | | 20 | 45 | | Plastic Lateral | 10-16 |
| OHS3030U[1] | | 205 | 250 | 0 | 160 | | 20 | 45 | | Plastic Lateral | 10-16 |
| OHN3040U[1] | | 150 | 200 | 50 | 115 | | 20 | 35 | | Plastic Lateral | 10-18 |
| OHS3040U[1] | | 150 | 200 | 50 | 115 | | 20 | 35 | | Plastic Lateral | 10-18 |
| OHN3075U[1] | 50 | 100 | 250 | -250 | -100 | -50 | 100 | 200 | 500 | Plastic Lateral | 10-20 |
| OHS3075U[1] | 50 | 100 | 250 | -250 | -100 | -50 | 100 | 200 | 500 | Plastic Lateral | 10-20 |
| OHN3113U[2] | | | 510 | 20 | | | 10 | | | Plastic Lateral | 10-22 |
| OHN3119U[2] | 100 | | 545 | 50 | | 495 | 50 | | | Plastic Lateral | 10-24 |
| OHS3119U[3] | 45 | | 575 | 25 | | 555 | 20 | | | Plastic Lateral | 10-24 |
| OHN3120U[2] | 70 | | 425 | 50 | | 405 | 20 | | | Plastic Lateral | 10-26 |
| OHS3120U[3] | 35 | | 450 | 25 | | 430 | 20 | | | Plastic Lateral | 10-26 |
| OHN3130U[2] | | | 175 | -175 | | | 20 | | | Plastic Lateral | 10-28 |
| OHS3130U[3] | | | 200 | -200 | | | 20 | | | Plastic Lateral | 10-28 |
| OHN3131U[2] | -75 | | 95 | -95 | | 85 | 10 | | | Plastic Lateral | 10-30 |
| OHS3131U[3] | -115 | | 135 | -135 | | 125 | 10 | | | Plastic Lateral | 10-30 |
| OHN3140U[2] | 45 | | 260 | 25 | | 240 | 20 | | | Plastic Lateral | 10-32 |
| OHS3140U[3] | 45 | | 270 | 25 | | 250 | 20 | | | Plastic Lateral | 10-32 |
| OHN3175U[2] | 15 | | 180 | -180 | | -15 | 80 | | | Plastic Lateral | 10-34 |
| OHS3175U[3] | 10 | | 260 | -10 | | -260 | 60 | | | Plastic Lateral | 10-34 |
| OHN3177U[2] | 25 | | 150 | -150 | | -25 | 50 | | | Plastic Lateral | 10-36 |
| OHS3177U[3] | 25 | | 200 | -200 | | -25 | 50 | | | Plastic Lateral | 10-36 |

**Operate Point at Temperature, $T_A$**

Note: (1) $T_A = 25^oC$
(2) $T_A = -20^oC$ to $85^oC$
(3) $T_A = -40^oC$ to $125^oC$

## Reflective Object Sensors

| Part No. | Output Type | Coupled Light Current $I_{C(ON)}$ Min* | Test Conditions $I_F$ (mA) | $V_{CE}$ (V) | d (inch) | Page No. |
|---|---|---|---|---|---|---|
| OPB606A | PT | 500 µA | 20 | 5.0 | 0.110 | 11-4 |
| OPB606B | PT | 350 µA | 20 | 5.0 | 0.110 | 11-4 |
| OPB606C | PT | 200 µA | 20 | 5.0 | 0.110 | 11-4 |
| OPB607A | PD | 25 mA | 20 | 5.0 | 0.110 | 11-6 |
| OPB607B | PD | 17 mA | 20 | 5.0 | 0.110 | 11-6 |
| OPB607C | PD | 10 mA | 20 | 5.0 | 0.110 | 11-6 |
| OPB700(AL) | PT | 25 µA | 40 | 5.0 | 0.200 | 11-8 |
| OPB701(AL) | PD | 2.0 mA | 40 | 5.0 | 0.200 | 11-10 |
| OPB703(W) | PT | 200 µA | 40 | 5.0 | 0.150 | 11-12 |
| OPB704(W) | PT | 200 µA | 40 | 5.0 | 0.150 | 11-12 |
| OPB705(W) | PT | 100 µA | 40 | 5.0 | 0.150 | 11-12 |
| OPB706A | PT | 500 µA | 20 | 5.0 | 0.050 | 11-16 |
| OPB706B | PT | 350 µA | 20 | 5.0 | 0.050 | 11-16 |
| OPB706C | PT | 200 µA | 20 | 5.0 | 0.050 | 11-16 |

d = distance from the assembly face to the reflective surface
* Test surface is an Eastman Kodak neutral white test card

## Reflective Object Sensors (cont)

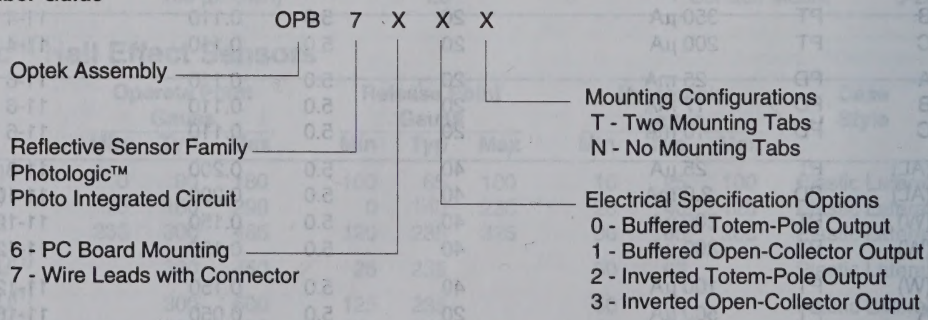
| Part No. | Output Type | Coupled Light Current $I_{C(ON)}$ Min* | Test Conditions $I_F$ (mA) | $V_{CE}$ (V) | d (inch) | Page No. |
|---|---|---|---|---|---|---|
| OPB707A | PD | 25 mA | 20 | 5.0 | 0.050 | 11-18 |
| OPB707B | PD | 17 mA | 20 | 5.0 | 0.050 | 11-18 |
| OPB707C | PD | 10 mA | 20 | 5.0 | 0.050 | 11-18 |
| OPB708 | PT | 10 µA | 40 | 5.0 | 0.150 | 11-20 |
| OPB709 | PD | 1.0 mA | 40 | 5.0 | 0.150 | 11-20 |
| OPB710(F) | PT | 150 µA | 50 | 5.0 | 0.250 | 11-24 |
| OPB711 | PT | 350 µA | 20 | 5.0 | 0.080 | 11-26 |
| OPB712 | PD | 20 mA | 20 | 5.0 | 0.080 | 11-28 |
| OPB730(F) | PD | 1.0 mA | 50 | 5.0 | 0.250 | 11-30 |
| OPB740(W) | PT | 50 µA | 40 | 5.0 | 0.150 | 11-32 |
| OPB741(W) | PT | 50 µA | 40 | 5.0 | 0.150 | 11-32 |
| OPB742(W) | PT | 10 µA | 40 | 5.0 | 0.150 | 11-32 |
| OPB743(W) | PT | 200 µA | 40 | 5.0 | 0.150 | 11-32 |
| OPB744(W) | PT | 200 µA | 40 | 5.0 | 0.150 | 11-32 |
| OPB745(W) | PD | 1.0 mA | 40 | 5.0 | 0.150 | 11-36 |
| OPB750N | PT | 500 µA | 30 | 5.0 | 0.080 | 11-40 |
| OPB750T | PT | 500 µA | 30 | 5.0 | 0.080 | 11-42 |
| OPB755N | PT | 500 µA | 30 | 5.0 | 0.080 | 11-44 |
| OPB755T | PT | 500 µA | 30 | 5.0 | 0.080 | 11-46 |

d = distance from the assembly face to the reflective surface
* Test surface is an Eastman Kodak neutral white test card

## Reflective Object Sensors - Photologic™

| Part No. | Output Type | Electrical Output | Page No. |
|---|---|---|---|
| OPB760N Series | logic | See Below | 11-48 |
| OPB760T Series | logic | See Below | 11-51 |
| OPB770N Series | logic | See Below | 11-54 |
| OPB770T Series | logic | See Below | 11-57 |

**Part Number Guide**


OPB 7 X X X
Optek Assembly
Reflective Sensor Family
Photologic™
Photo Integrated Circuit
6 - PC Board Mounting
7 - Wire Leads with Connector
Mounting Configurations
T - Two Mounting Tabs
N - No Mounting Tabs
Electrical Specification Options
0 - Buffered Totem-Pole Output
1 - Buffered Open-Collector Output
2 - Inverted Totem-Pole Output
3 - Inverted Open-Collector Output

# Slotted Optical Switches - Phototransistor

OPTEK

| Part No. | Coupled Light Current $I_{C(ON)}$ Min | Test Conditions $I_F$ (mA) | Test Conditions $V_{CE}$ (V) | Slot Width/ Lead Spacing (Inches) | Page No. |
|---|---|---|---|---|---|
| CNY36 | 200 µA | 20 | 10.0 | 0.120/0.220 | 12-4 |
| OPB610 | 1 mA | 5 | 5.0 | 0.15/0.275 | 12-10 |
| OPB620 | 1 mA | 5 | 5.0 | 0.19/0.320 | 12-16 |
| OPB660N | 600 µA | 10 | 5.0 | 0.125/0.320 | 12-22 |
| OPB660T | 600 µA | 10 | 5.0 | 0.125/0.320 | 12-22 |
| OPB804 | 500 µA | 20 | 10.0 | 0.155/0.300 | 12-54 |
| OPB806 | 0.40 mA | 20 | 0.5 | 0.125/NA | 12-56 |
| OPB818 | 100 µA | 20 | 10.0 | 0.200/0.400 | 12-58 |
| OPB820 | 500 µA | 20 | 5.0 | 0.080/0.275 | 12-60 |
| OPB820S3 | 60 µA | 20 | 5.0 | 0.080/0.275 | 12-60 |
| OPB820S5 | 300 µA | 20 | 5.0 | 0.080/0.275 | 12-60 |
| OPB820S10 | 400 µA | 20 | 5.0 | 0.080/0.275 | 12-60 |
| OPB821 | 500 µA | 20 | 5.0 | 0.080/Wire | 12-62 |
| OPB821S3 | 60 µA | 20 | 5.0 | 0.080/Wire | 12-62 |
| OPB821S5 | 300 µA | 20 | 5.0 | 0.080/Wire | 12-62 |
| OPB821S10 | 400 µA | 20 | 5.0 | 0.080/Wire | 12-62 |
| OPB822S[2] | 250 µA | 20 | 10.0 | 0.090/0.300 | 12-64 |
| OPB822SD[2] | 100 µA | 20 | 10.0 | 0.090/0.300 | 12-64 |
| OPB825(A)(B) | 500 µA | 20 | 10.0 | 0.160/0.300 | 12-66 |
| OPB826S[3] | 250 µA | 20 | 10.0 | 0.100/0.740 | 12-68 |
| OPB826SD[3] | 100 µA | 20 | 10.0 | 0.100/0.740 | 12-68 |
| OPB827A(B)(C)(D) | 1.8 mA | 20 | 0.6 | 0.125/0.300 | 12-70 |
| OPB828A(B)(C)(D) | 1.8 mA | 20 | 0.6 | 0.125/0.220 | 12-72 |
| OPB829A(B)(C)(D) | 1.8 mA | 20 | 0.6 | 0.125/Wire | 12-74 |
| OPB844A(B) | 1.8 mA | 20 | 0.6 | 0.125/0.300 | 12-84 |
| OPB845A(B) | 1.8 mA | 20 | 0.6 | 0.125/0.300 | 12-86 |
| OPB847 | 4.0 mA | 20 | 10.0 | 0.100/0.300 | 12-88 |
| OPB848 | 1.0 mA | 20 | 10.0 | 0.100/0.300 | 12-88 |
| OPB852A1 | 1.0 mA | 20 | 5.0 | 0.125/0.290 | 12-92 |
| OPB852A2 | 2.0 mA | 20 | 5.0 | 0.125/0.290 | 12-92 |
| OPB852A3 | 4.0 mA | 20 | 5.0 | 0.125/0.290 | 12-92 |
| OPB853A1[1] | 2.5 mA | 5 | 1.5 | 0.125/0.290 | 12-94 |
| OPB853A2[1] | 5.0 mA | 5 | 1.5 | 0.125/0.290 | 12-94 |
| OPB853A3[1] | 10.0 mA | 5 | 1.5 | 0.125/0.290 | 12-94 |
| OPB854A1 | 3.0 mA | 16 | 1.0 | 0.100/0.300 | 12-96 |
| OPB854A2 | 3.0 mA | 16 | 1.0 | 0.100/0.300 | 12-98 |
| OPB854A3 | 3.0 mA | 16 | 1.0 | 0.100/0.300 | 12-100 |
| OPB854B1 | 1.0 mA | 20 | 10.0 | 0.100/0.300 | 12-96 |
| OPB854B2 | 1.0 mA | 20 | 10.0 | 0.100/0.300 | 12-98 |
| OPB854B3 | 1.0 mA | 20 | 10.0 | 0.100/0.300 | 12-100 |
| OPB855 | 500 µA | 20 | 5.0 | 0.205/0.380 | 12-102 |
| OPB856 | 1.8 mA | 20 | 5.0 | Variable | 12-104 |
| OPB857 | 1.5 mA | 20 | 10.0 | 0.15/Wire | 12-106 |
| OPB859 | 250 µA | 20 | 10.0 | 0.125/0.220 | 12-108 |

(1) Photodarlington Output all others Phototransistor
(2) Dual channel horizontal
(3) Dual channel vertical

# Slotted Optical Switches - Phototransistor

OPTEK

| Part No. | Electrical Characteristics | Slot Width/ Lead Spacing | Page No. |
|---|---|---|---|
| OPB800L/OPB810L Series | See Below | 0.375/0.570 | 12-46 |
| OPB800W/OPB810W Series | See Below | 0.375/ NA | 12-50 |
| OPB830L/OPB840L Series | See Below | 0.125/ * | 12-76 |
| OPB830W/OPB840W Series | See Below | 0.125/ NA | 12-80 |
| OPB860/OPB870 Series | See Below | 0.125/ * | 12-110 |
| OPB880/OPB890 Series | See Below | 0.125/ NA | 12-114 |

Electrical characteristics

| | Collector-Emitter Saturation Voltage | Max. | Test Conditions |
|---|---|---|---|
| $V_{CE(SAT)}$ | Parameter A | 0.4V | $I_C$ = 400 µA, $I_F$ = 20mA |
| | Parameter B | 0.4V | $I_C$ = 800 µA, $I_F$ = 10mA |
| | Parameter C | 0.6V | $I_C$ = 1800 µA, $I_F$ = 20mA |
| | **On-State Collector Current** | **Min.** | **Test Conditions** |
| $I_{C(ON)}$ | Parameter A | 500µA | $V_{CE}$ = 10V, $I_F$ = 20mA |
| | Parameter B | 1000µA | $V_{CE}$ = 5V, $I_F$ = 10mA |
| | Parameter C | 1800µA | $V_{CE}$ = 0.6V, $I_F$ = 20mA |

## Part Number Guide

**OPB 8 X X X X X**

Optek Assembly Prefix

Slotted Optical Switch
8 = Phototransistor Output

Housing
0 = Wide Gap Transmissive
1 = Wide Gap Opaque
3 = Side Mount Transmissive
4 = Side Mount Opaque
6 = PC Termination Transmissive
7 = PC Termination Opaque
8 = Wire Termination Transmissive
9 = Wire Termination Opaque

Mechanical and Electrical Specification Variations
0 = Electrical parameter A lead spacing 0.320" (8.13mm)
1 = Electrical parameter B lead spacing 0.320" (8.13mm)
2 = Electrical parameter C lead spacing 0.320" (8.13mm)
5 = Electrical parameter A lead spacing 0.220" (5.59mm)
6 = Electrical parameter B lead spacing 0.220" (5.59mm)
7 = Electrical parameter C lead spacing 0.220" (5.59mm)

**Mounting Configurations**
T = Both mounting tabs
N = No tabs
L = Single mounting tab,Emitter side
P = Single mounting tab, Sensor side
**Wide Gap and Side Mount**
W = Wire Termination
L = PC Lead Termination

**Aperture width in front of LED**
5 = 0.050" (1.27mm) *1 = 0.010"(0.25mm)
*Available only with electrical parameter A

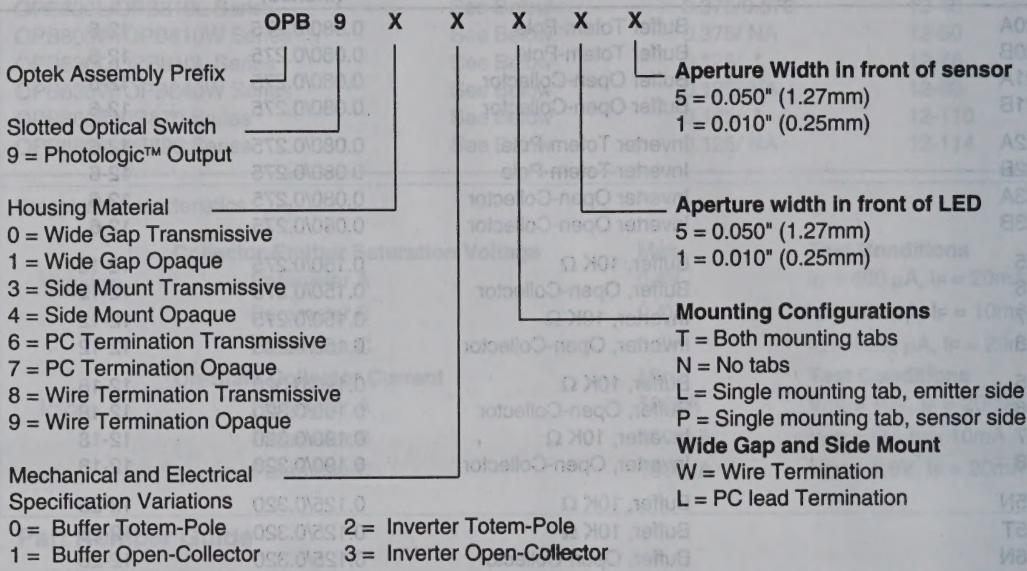
**Aperture Width in front of sensor**
5 = 0.050" (1.27mm)
1 = 0.010" (0.25mm)

Wide gap switch: lead spacing is 0.570" (14.48mm) Electrical specifications 0,1& 2

# Slotted Optical Switches - Photologic™

| Part No. | Electrical Characteristics | Slot Width/ Lead Spacing (Inches) | Page No. |
|---|---|---|---|
| OPB120A | Buffer Totem-Pole | 0.080/0.275 | 12-6 |
| OPB120B | Buffer Totem-Pole | 0.080/0.275 | 12-6 |
| OPB121A | Buffer Open-Collector | 0.080/0.275 | 12-6 |
| OPB121B | Buffer Open-Collector | 0.080/0.275 | 12-6 |
| OPB122A | Inverter Totem-Pole | 0.080/0.275 | 12-6 |
| OPB122B | Inverter Totem-Pole | 0.080/0.275 | 12-6 |
| OPB123A | Inverter Open-Collector | 0.080/0.275 | 12-6 |
| OPB123B | Inverter Open-Collector | 0.080/0.275 | 12-6 |
| OPB615 | Buffer, 10K Ω | 0.150/0.275 | 12-12 |
| OPB616 | Buffer, Open-Collector | 0.150/0.275 | 12-12 |
| OPB617 | Inverter, 10K Ω | 0.150/0.275 | 12-12 |
| OPB618 | Inverter, Open-Collector | 0.150/0.275 | 12-12 |
| OPB625 | Buffer, 10K Ω | 0.190/0.320 | 12-18 |
| OPB626 | Buffer, Open-Collector | 0.190/0.320 | 12-18 |
| OPB627 | Inverter, 10K Ω | 0.190/0.320 | 12-18 |
| OPB628 | Inverter, Open-Collector | 0.190/0.320 | 12-18 |
| OPB665N | Buffer, 10K Ω | 0.125/0.320 | 12-26 |
| OPB665T | Buffer, 10K Ω | 0.125/0.320 | 12-26 |
| OPB666N | Buffer, Open-Collector | 0.125/0.320 | 12-26 |
| OPB666T | Buffer, Open-Collector | 0.125/0.320 | 12-26 |
| OPB667N | Inverter, 10K Ω | 0.125/0.320 | 12-26 |
| OPB667T | Inverter, 10K Ω | 0.125/0.320 | 12-26 |
| OPB668N | Inverter, Open-Collector | 0.125/0.320 | 12-26 |
| OPB668T | Inverter, Open-Collector | 0.125/0.320 | 12-26 |
| OPB900L/OPB910L Series | See Next Page | 0.375/0.570 | 12-118 |
| OPB900W/OPB910W Series | See Next Page | 0.375/NA | 12-122 |
| OPB930/OPB940L Series | See Next Page | 0.125/0.320 | 12-126 |
| OPB930W/OPB940W | See Next Page | 0.125/NA | 12-130 |
| OPB960/OPB970 | See Next Page | 0.125/0.320 | 12-134 |
| OPB980/OPB990 | See Next Page | 0.125/NA | 12-140 |

## Part Number Guide


OPB 9 X X X X X
Optek Assembly Prefix
Slotted Optical Switch
9 = Photologic™ Output
Housing Material
0 = Wide Gap Transmissive
1 = Wide Gap Opaque
3 = Side Mount Transmissive
4 = Side Mount Opaque
6 = PC Termination Transmissive
7 = PC Termination Opaque
8 = Wire Termination Transmissive
9 = Wire Termination Opaque
Mechanical and Electrical
Specification Variations
0 = Buffer Totem-Pole
1 = Buffer Open-Collector
2 = Inverter Totem-Pole
3 = Inverter Open-Collector
Aperture Width in front of sensor
5 = 0.050" (1.27mm)
1 = 0.010" (0.25mm)
Aperture width in front of LED
5 = 0.050" (1.27mm)
1 = 0.010" (0.25mm)
Mounting Configurations
T = Both mounting tabs
N = No tabs
L = Single mounting tab, emitter side
P = Single mounting tab, sensor side
Wide Gap and Side Mount
W = Wire Termination
L = PC lead Termination

## Optical Flag Switches

| Part No. | Coupled Light Current $I_{C(ON)}$ Min | Test Conditions $I_F$ (mA) | Test Conditions $V_{CE}$ (V) | Lead Spacing (Inches) | Page No. |
|---|---|---|---|---|---|
| OPB680 | 600 µA | 10 | 5.0 | 0.275 | 12-32 |
| OPB685 | logic | 10 | 4.5-16.0 | 0.275 | 12-34 |
| OPB686 | logic | 10 | 4.5-16.0 | 0.275 | 12-34 |
| OPB687 | logic | 10 | 4.5-16.0 | 0.275 | 12-34 |
| OPB688 | logic | 10 | 4.5-16.0 | 0.275 | 12-34 |
| OPB690 | 600 µA | 10 | 5.0 | Connector | 12-38 |
| OPB695A(B)(C) | logic | 10 | 4.5-16.0 | Connector | 12-40 |
| OPB696A(B)(C) | logic | 10 | 4.5-16.0 | Connector | 12-40 |
| OPB697A(B)(C) | logic | 10 | 4.5-16.0 | Connector | 12-40 |
| OPB698A(B)(C) | logic | 10 | 4.5-16.0 | Connector | 12-40 |
| OPB850 | 500 µA | 20 | 10.0 | Wire | 12-90 |

## Hi-Rel Infrared Emitting Diodes

| Part No. | Type | Output Power | Test Conditions $I_F$ (mA) | Case Style | Page No. |
|---|---|---|---|---|---|
| OP223TX(TXV) | GaAlAs | 1.00mW | 50 | Pill | 13-44 |
| OP224TX(TXV) | GaAlAs | 1.50mW | 50 | Pill | 13-44 |
| OP235TX(TXV) | GaAlAs | 1.5mW/cm$^2$ | 100 | TO-46 | 13-48 |
| OP236TX(TXV) | GaAlAs | 3.5mW/cm$^2$ | 100 | TO-46 | 13-48 |

## Hi-Rel Photosensors

| Part No. | Light Current | Test Conditions | Case Style | Page No. |
|---|---|---|---|---|
| OP602TX(TXV) | 2.0-5.0mA | $E_e$ = 20mW/cm$^2$, $V_{CE}$ = 5V | Pill | 13-52 |
| OP603TX(TXV) | 4.0-8.0mA | $E_e$ = 20mW/cm$^2$, $V_{CE}$ = 5V | Pill | 13-52 |
| OP604TX(TXV) | 7.0mA | $E_e$ = 20mW/cm$^2$, $V_{CE}$ = 5V | Pill | 13-52 |
| OP803TX(TXV) | 4.0-8.0mA | $E_e$ = 5mW/cm$^2$, $V_{CE}$ = 5V | TO-18 | 13-56 |
| OP804TX(TXV) | 7.0-22.0mA | $E_e$ = 5mW/cm$^2$, $V_{CE}$ = 5V | TO-18 | 13-56 |
| OP805TX(TXV) | 15.0mA | $E_e$ = 5mW/cm$^2$, $V_{CE}$ = 5V | TO-18 | 13-56 |
| OPL800TXV | Logic | Totem-pole | TO-18 | 13-80 |

## Hi-Rel Optical Isolators

| Part No. | Isolation | $I_{C(ON)}$ | Test Conditions | Case Style | Page No. |
|---|---|---|---|---|---|
| 3N243(TX) | 1kV | 1.5mA min | $I_F$ = 10mA, $V_{CE}$ = 10V | TO-72 | 13-4 |
| 3N244(TX) | 1kV | 3.0mA min | $I_F$ = 10mA, $V_{CE}$ = 10V | TO-72 | 13-4 |
| 3N245(TX) | 1kV | 6.0mA min | $I_F$ = 10mA, $V_{CE}$ = 10V | TO-72 | 13-4 |
| 3N261(TX) | 1kV | 0.5mA min | $I_F$ = 1mA, $V_{CE}$ = 5V | TO-72 | 13-10 |
| 3N262(TX) | 1kV | 1.0-5.0mA | $I_F$ = 1mA, $V_{CE}$ = 5V | TO-72 | 13-10 |
| 3N263(TX) | 1kV | 2.0-10.0mA | $I_F$ = 1mA, $V_{CE}$ = 5V | TO-72 | 13-10 |
| 4N22A(JANTX) (JANTXV) | 1kV | 2.5mA min | $I_F$ = 10mA, $V_{CE}$ = 5V | TO-78 | 13-16 |
| 4N22AU(JANTX) (JANTXV) | 1kV | 2.5mA min | $I_F$ = 10mA, $V_{CE}$ = 5V | SMD | 13-22 |
| 4N23A(JANTX) (JANTXV) | 1kV | 6.0mA min | $I_F$ = 10mA, $V_{CE}$ = 5V | TO-78 | 13-16 |
| 4N23AU(JANTX) (JANTXV) | 1kV | 6.0mA min | $I_F$ = 10mA, $V_{CE}$ = 5V | SMD | 13-22 |
| 4N24A(JANTX) (JANTXV) | 1kV | 10.0mA min | $I_F$ = 10mA, $V_{CE}$ = 5V | TO-78 | 13-16 |
| 4N24AU(JANTX) (JANTXV) | 1kV | 10.0mA min | $I_F$ = 10mA, $V_{CE}$ = 5V | SMD | 13-22 |
| 4N47(JANTX)(JANTXV) | 1kV | 0.5mA min | $I_F$ = 1.0mA, $V_{CE}$ = 5V | TO-78 | 13-26 |
| 4N48(JANTX)(JANTXV) | 1kV | 1.0-5.0mA | $I_F$ = 1.0mA, $V_{CE}$ = 5V | TO-78 | 13-26 |
| 4N49(JANTX)(JANTXV) | 1kV | 2.0-10.0mA | $I_F$ = 1.0mA, $V_{CE}$ = 5V | TO-78 | 13-26 |
| HCC135(TXV) | 1kV | logic | | SMD | 13-30 |
| HCC136(TXV) | 1kV | logic | | SMD | 13-30 |
| HCC240 | 1kV | 2.5mA min | $I_F$ = 10mA, $V_{CE}$ = 5V | SMD | 13-32 |
| HCC242 | 1kV | 10.0mA min | $I_F$ = 10mA, $V_{CE}$ = 5V | SMD | 13-32 |
| HCC247 | 1kV | 0.5mA min | $I_F$ = 1.0mA, $V_{CE}$ = 5V | SMD | 13-34 |
| HCC248 | 1kV | 1.0-5.0mA | $I_F$ = 1.0mA, $V_{CE}$ = 5V | SMD | 13-34 |
| HCC249 | 1kV | 2.0-10.0mA | $I_F$ = 1.0mA, $V_{CE}$ = 5V | SMD | 13-34 |
| HCC340 | 1.5kV | zero crossing triac | | SMD | 13-36 |
| HCC640(TXV) | 1.5kV | 4.8mA min | $I_F$ = 1.6mA, $V_O$ = 0.4V, $V_{CC}$ = 4.5V | SMD | 13-38 |
| HDA140A | 1.5kV | 4.8mA min | $I_F$ = 1.6mA, $V_O$ = 0.4V, $V_{CC}$ = 4.5V | 4 ch. Dip | 13-40 |
| HDC135 | 1kV | logic | | Dip | 13-42 |
| HDC136 | 1kV | logic | | Dip | 13-42 |

## Hi-Rel Optical Isolators (cont)

| Part No. | Isolation | $I_{C(ON)}$ | Test Conditions | Case Style | Page No. |
|---|---|---|---|---|---|
| OPI120TX(TXV) | 15kV | 2.0mA | $I_F$ = 10mA, $V_{CE}$ = 5V | Axial | 13-70 |
| OPI125TXV | 15kV | logic | $V_{CC}$ = 5V | Axial | 13-72 |
| OPI150TX(TXV) | 50kV | 1.0mA | $I_F$ = 10mA, $V_{CE}$ = 5V | Axial | 13-74 |
| OPI210 | 1.0kV | 5mA min | $I_F$ = 10mA, $V_{CE}$ = 5V | SMD | 13-76 |
| OPI211 | 1.0kV | 20mA min | $I_F$ = 10mA, $V_{CE}$ = 5V | SMD | 13-76 |
| OPI340 | 1.0kV | zero crossing triac | | TO-78 | 13-78 |

## Hi-Rel Optical Assemblies

| Part No. | Type | $I_{C(ON)}$ | Test Conditions | Page No. |
|---|---|---|---|---|
| OPB700TX(TXV) | reflective | 50μA min | $V_{CE}$ = 5V, $I_F$ = 40mA | 13-60 |
| OPB821TX(TXV) | slotted | 800μA min | $V_{CE}$ = 10V, $I_F$ = 20mA | 13-62 |
| OPB847TX(TXV) | slotted | 4.0mA min | $V_{CE}$ = 10V, $I_F$ = 20mA | 13-64 |
| OPB848TX(TXV) | slotted | 1.0mA min | $V_{CE}$ = 10V, $I_F$ = 20mA | 13-64 |
| OPB870X5XTX(TV) | slotted | 500μA min | $V_{CE}$ = 10V, $I_F$ = 20mA | 13-66 |
| OPB871X5XTX(TV) | slotted | 1.0mA min | $V_{CE}$ = 5V, $I_F$ = 10mA | 13-66 |
| OPB872X5XTX(TV) | slotted | 1.8mA min | $V_{CE}$ = 0.4V, $I_F$ = 20mA | 13-66 |

## Hi-Rel Fiber Optics

### LEDs

| Part No. | Output Power (μW) | | Test Conditions $I_F$ | Rise Time Typ | Case Style | Page No. |
|---|---|---|---|---|---|---|
| | Min | Typ | (mA) | (ns) | | |
| OMF320TX(TXV) | 15.0 | 19.0 | 100 | 6.0 | TO-46 | 14-2 |
| OMF321TX(TXV) | 15.0 | 19.0 | 100 | 6.0 | SMA | 14-4 |
| OMF322TX(TXV) | 15.0 | 19.0 | 100 | 6.0 | ST* | 14-6 |
| OMF340TX(TXV) | 20.0 | 25.0 | 100 | 4.5 | TO-46 | 14-8 |
| OMF341TX(TXV) | 20.0 | 25.0 | 100 | 4.5 | SMA | 14-10 |
| OMF342TX(TXV) | 20.0 | 25.0 | 100 | 4.5 | ST* | 14-12 |
| OMF345TX(TXV) | 20.0 | 25.0 | 100 | 3.5 | TO-46 | 14-14 |
| OMF346TX(TXV) | 20.0 | 25.0 | 100 | 3.5 | SMA | 14-16 |
| OMF347TX(TXV) | 20.0 | 25.0 | 100 | 3.5 | ST* | 14-18 |

### Photodiodes

| Part No. | Responsivity (A/W) | | Test Conditions | Rise Time Typ | Case Style | Page No. |
|---|---|---|---|---|---|---|
| | Min | Typ | | (ns) | | |
| OMF420TX/(TXV) | 0.45 | 0.55 | $V_R$ = 5V, $P_O$ = 10μW | 6.0 | TO-46 | 14-20 |
| OMF421TX/(TXV) | 0.45 | 0.55 | $V_R$ = 5V, $P_O$ = 10μW | 6.0 | SMA | 14-22 |
| OMF422TX/(TXV) | 0.45 | 0.55 | $V_R$ = 5V, $P_O$ = 10μW | 6.0 | ST* | 14-24 |
| OMF430TX/(TXV) | 0.45 | 0.55 | $V_R$ = 5V, $P_O$ = 10μW | 2.0 | TO-46 | 14-26 |
| OMF431TX/(TXV) | 0.45 | 0.55 | $V_R$ = 5V, $P_O$ = 10μW | 2.0 | SMA | 14-28 |
| OMF432TX/(TXV) | 0.45 | 0.55 | $V_R$ = 5V, $P_O$ = 10μW | 2.0 | ST* | 14-30 |

*ST is a registered trademark of AT&T

## Hi-Rel Hall Effect

| Part No. | Operate Point | | | Release Point | | | Hysteresis | | | Case Style | Page No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | | |
| OMH090B(S) | 50 | 90 | 180 | 30 | 60 | 160 | 5 | 30 | 70 | Ceramic | 15-2 |
| OMH360B(S) | 235 | 360 | 465 | 170 | 280 | 360 | 30 | 80 | 150 | Ceramic | 15-14 |
| OMH3019B(S) | 175 | 420 | 500 | 125 | 220 | 420 | 30 | 100 | 155 | Ceramic | 15-4 |
| OMH3020B(S) | 70 | 220 | 350 | 50 | 165 | 330 | 20 | 55 | 200 | Ceramic | 15-6 |
| OMH3040B(S) | 70 | 150 | 200 | 50 | 115 | 180 | 10 | 35 | 60 | Ceramic | 15-8 |
| OMH3075B(S) | 50 | 150 | 250 | -250 | -150 | -50 | 100 | 300 | 500 | Ceramic | 15-10 |
| OMH3131B(S) | 20 | 60 | 95 | 10 | 45 | 85 | 5 | 15 | 40 | Ceramic | 15-12 |

## Hi-Rel Surface Mount Semiconductors

### Transistors

| Part No. | Type | $H_{FE}$ | Test Conditions | Page No. |
|---|---|---|---|---|
| 2N2907AUA(JANTX) (JANTXV) | PNP | 100-300 | $V_{CE}$ = 10V, $I_C$ = 150mA | 16-2 |
| 2N2907AUB(JANTX) (JANTXV) | PNP | 100-300 | $V_{CE}$ = 10V, $I_C$ = 150mA | 16-4 |
| 2N4854U(JANTX) (JANTXV) | NPN/PNP pair | 100-300 | $V_{CE}$ = 10V, $I_C$ = 150mA | 16-6 |
| HCT2222A(TX) | NPN | 100-300 | $V_{CE}$ = 10V, $I_C$ = 150mA | 16-8 |
| HCT2222M(TX) | NPN | 100-300 | $V_{CE}$ = 10V, $I_C$ = 150mA | 16-10 |
| HCT700(TX)(TXV) | NPN/PNP pair | 100-300 | $V_{CE}$ = 10V, $I_C$ = 150mA | 16-12 |
| HCT720(TX)(TXV) | dual NPN | 100-300 | $V_{CE}$ = 10V, $I_C$ = 150mA | 16-14 |
| HCT740(TX)(TXV) | dual PNP | 100-300 | $V_{CE}$ = 10V, $I_C$ = 150mA | 16-16 |
| HCT780(TX)(TXV) | quad NPN | 100-300 | $V_{CE}$ = 10V, $I_C$ = 150mA | 16-18 |
| HCT790(TX)(TXV) | quad PNP | 100-300 | $V_{CE}$ = 10V, $I_C$ = 150mA | 16-20 |

### Enhancement MOSFETs

| Part No. | Type | $rds_{(on)}$ | Test Conditions | Page No. |
|---|---|---|---|---|
| HCT801(TX) | dual | 3.2/8 Ω (max) | $V_{GS}$ = ±10V, $I_D$ = ±1A | 16-22 |
| HCT802(TX) | dual | 5/5 Ω (max) | $V_{GS}$ = ±10V, $I_D$ = ±1A | 16-24 |
| HCT7000M(TX)(TXV) | n-channel | 5 Ω (max) | $V_{GS}$ = 10V, $I_D$ =0.5mA | 16-26 |

### Optical Isolators

Listed under Hi-Rel Optical Isolators (See SMD case style).

## Hi-Rel Optical Isolators (cont)

| Part No. | Page No. | Case Style | Hysteresis | Operate Point | | | Release Point | | | Test Conditions |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Typ | Max | | |
| OMH309B(B) | 18-6 | Ceramic | 30 | | 70 | 160 | | 260 | | $V_{CE}$ = 5V, $I_F$ = 40mA |
| OMH330B(B) | 18-8 | Ceramic | 60 | | 150 | 280 | | 360 | | $V_{CE}$ = 5V, $I_F$ = 40mA |
| OMH3015B(B) | 18-6 | Ceramic | 100 | | 155 | 420 | | 520 | | $V_{CE}$ = 5V, $I_F$ = 40mA |
| OMH3035B(B) | 18-8 | Ceramic | 55 | | 200 | 330 | | 465 | | $V_{CE}$ = 5V, $I_F$ = 40mA |
| OMH3040B(B) | 18-8 | Ceramic | 35 | | 80 | 180 | | 280 | | $V_{CE}$ = 5V, $I_F$ = 40mA |
| OMH3075B(B) | 18-10 | Ceramic | 300 | | 800 | -150 | | -250 | | $V_{CE}$ = 5V, $I_F$ = 40mA |
| OMH3738(B) | 18-12 | Ceramic | 15 | | 40 | 85 | | 140 | | $V_{CE}$ = 5V, $I_F$ = 40mA |

## Hi-Rel Optical Assemblies

### Hi-Rel Surface Mount Semiconductors

#### Transistors

| Part No. | Page No. | Type | Test Conditions |
|---|---|---|---|
| 2N2907AUB(JANTX) (JANTXV) | 13-4 | PNP | $V_{CE}$ = 10V, $I_C$ = 150mA |
| 2N2907AUB(JANTX) (JANTXV) | 13-4 | PNP | $V_{CE}$ = 10V, $I_C$ = 150mA |
| 2N4854U(JANTX) (JANTXV) | 13-6 | PNP/PNP pair | $V_{CE}$ = 10V, $I_C$ = 150mA |
| HCT2222A(TX) | 16-8 | NPN | $V_{CE}$ = 10V, $I_C$ = 150mA |
| HCT2222M(TX) | 16-10 | NPN | $V_{CE}$ = 10V, $I_C$ = 150mA |
| HCT700(TX)(TXV) | 16-12 | NPN/PNP pair | $V_{CE}$ = 10V, $I_C$ = 150mA |
| HCT720(TX)(TXV) | 16-14 | dual NPN | $V_{CE}$ = 10V, $I_C$ = 150mA |
| HCT740(TX)(TXV) | 16-16 | dual PNP | $V_{CE}$ = 10V, $I_C$ = 150mA |
| HCT780(TX)(TXV) | 16-18 | quad NPN | $V_{CE}$ = 10V, $I_C$ = 150mA |
| HCT790(TX)(TXV) | 16-20 | quad PNP | $V_{CE}$ = 10V, $I_C$ = 150mA |

#### Enhancement MOSFETs

| Part No. | Page No. | Type | $r_{DS(on)}$ | Test Conditions |
|---|---|---|---|---|
| HCT801(TX) | 14-10 | dual | 3.5Ω (max) | $V_{GS}$ = ±10V, $I_D$ = ±1A |
| HCT802(TX) | 14-12 | dual | 5Ω (max) | $V_{GS}$ = ±10V, $I_D$ = ±1A |
| HCT7000M(TX)(TXV) | 14-14 | n-channel | 0.5Ω (max) | $V_{GS}$ = 10V, $I_D$ = 3A |

### Optical Isolators

Listed under Hi-Rel Optical Isolators (See SMD case style).

### Photodiodes

| Part No. | Page No. | Responsivity (A/W) | | Test Conditions | Rise Time Typ (ns) | Case Style |
|---|---|---|---|---|---|---|
| | | Min | Typ | | | |
| OMF420TX(TXV) | 14-20 | 0.48 | 0.55 | $V_R$ = 5V, $P_O$ = 10µW | 6.0 | TO-46 |
| OMF421TX(TXV) | 14-22 | 0.46 | 0.55 | $V_R$ = 5V, $P_O$ = 10µW | 6.0 | SMA |
| OMF422TX(TXV) | 14-24 | 0.46 | 0.55 | $V_R$ = 5V, $P_O$ = 10µW | 6.0 | ST* |
| OMF430TX(TXV) | 14-26 | 0.45 | 0.55 | $V_R$ = 5V, $P_O$ = 10µW | 2.0 | TO-46 |
| OMF431TX(TXV) | 14-28 | 0.45 | 0.55 | $V_R$ = 5V, $P_O$ = 10µW | 2.0 | SMA |
| OMF432TX(TXV) | 14-30 | 0.45 | 0.55 | $V_R$ = 5V, $P_O$ = 10µW | 2.0 | ST* |

*ST is a registered trademark of AT&T

OPTEK TECHNOLOGY, INC.

# INFRARED EMITTING DIODES

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Infrared Emitting Diodes

Optek remains unchallenged as the industry's most complete high quality source for infrared emitters. The latest state-of-the-art solution grown epitaxial techniques are used to produce the high quality GaAs and GaAlAs diode material required to make Optek infrared emitting diodes. This precision processing ensures high junction emission efficiency and long operating life with minimal degradation. The added benefit of over 16 years of mounting, bonding, and packaging experience makes Optek the undisputed technological leader in the design and production of infrared emitting diodes.

## Leadership in Manufacturing

When engineers are asked which product features they value most in Optek's electronic components, the answers most often given are quality and reliability. Assuring high quality is a philosophy that begins at product conception and is carried through the design phase and heavily emphasized during every step in the manufacture of Optek infrared emitting diodes.

Production begins in Optek's own wafer processing area located in Carrollton, Texas. A GaAlAs or GaAs melt is added to high purity GaAs wafers at precisely controlled temperatures. As cooling takes place, the crystalline structure begins to grow. Partially into the growth, at exactly the right temperature, the material changes from "N"-type to "P"-type and the diode junction is formed. To complete the process, excess starting material is removed and metallization layers are added for electrical contacts. The individual diode chips are then sliced from the wafer. Application Bulletin 205, printed in this data book, discusses these materials in additional detail.

The infrared emitting diode is then carefully mounted in a specially designed reflective "well" as shown in Figure 1. Depending upon the device type, conductive epoxy or soldering is used to attach the chip to the lead frame or header. Gold wire is bonded to the top contact pad ("N" - type material) using Optek's specially developed techniques designed to minimize stress or possible damage to the delicate chip material. A refractive index matching silicone overcoat is added to "ruggedize" the entire assembly and improve optical efficiency. Hermetic parts are then weld-sealed. After assembly, 100 percent of the devices are electrically tested and sorted in order to guarantee compliance with the electrical limits specified in Optek data sheets. Prior to final release for shipment, Optek's outgoing quality control department independently retests samples from each lot.

## Output Specifications Designed for Engineering Convenience

The outputs of the vast majority of Optek emitters are specified using apertured radiant incidence, $E_{e(APT)}$, expressed in milliwatts per square centimeter. This method, also known as on-axis intensity measurement, provides the best accuracy and convenience for the design engineer. Production testing consists of measuring 100 percent of the energy passing through a specified diameter aperture orthogonal to the optical axis, and a specified distance from the device. For Optek devices, the distance chosen for this measurement is equivalent to the typical operating distance from emitter to sensor. Most specifications for compatible photosensors describe output current at a specified radiant intensity, also expressed in milliwatts per square centimeter. Therefore, the design of close proximity transmissive emitter/sensor assemblies can be done more accurately, and with a minimum of optical calculations and specification conversions.

Infrared emitter manufacturers use three methods of specifying output limits on infrared emitters. These are Radiant Power Output ($P_O$), Radiant Intensity ($I_e$) and Apertured Radiant Incidence [$E_{e(APT)}$]. Radiant Power Output ($P_O$) sometimes called Total Power, is strictly interpreted as a measure of the total energy emitted from the device. Optek has interpreted this to include only the energy useful to most customers. Therefore, side and backward emissions are not measured. As a benchmark for comparison among devices, Optek devices are conservatively rated. For example, the $P_O$ reading for the useful portion of the OP295A radiation pattern is 60 percent higher when a parabolic reflector is used to capture normally unused side emissions as opposed to Optek's more conservative rating method. When making $P_O$ comparisons among manufacturers, the design engineer should always investigate the methods of measurement.

Radiant Intensity ($I_e$) is usually expressed in milliwatts per steradian. This method attempts to account for useable energy, where the peak intensity falls within an included angle centered around the optical axis. Through some moderately complex geometrical calculations, the energy falling on the sensor can be roughly estimated if the sensor is on or close to the optical axis and if the distance from emitter to sensor is known. However, most infrared emitters can not accurately be modeled as a point source at the close proximity used in many applications (less than four inches); therefore, this method has the potential to result in serious design errors. Additionally, it is more cumbersome than Optek's direct approach of characterizing emitters in terms of apertured radiant incidence.

## Diode Material Selection

Gallium arsenide (GaAs) and gallium aluminum arsenide (GaAlAs) each have specific advantages when used in the manufacture of Optek infrared emitters. GaAs emits energy at 935 ±15 nanometers while GaAlAs emits at 890 ±20 nanometers. As temperature increases, these peaks shift upward by 0.26 and 0.20 nanometers per degree centigrade, respectively. Due to the spectral matching with photosensitive silicon, which exhibits a sensitivity maximum of 850 nanometers, as shown in Figure 2, (the second peak is caused by a fractional wave sensor overcoat), GaAlAs has the advantage of more efficient coupling. The sensor is better able to "see" the energy emitted by GaAlAs. In addition, at equivalent forward currents, GaAlAs is typically a more efficient emitter of infrared energy.

GaAs is considered to be less susceptible to output degradation than GaAlAs. Figure 3 shows typical percentage changes in output versus time for GaAs and GaAlAs operating at the absolute maximum forward current rating of $I_F$ = 100 mA, on a TO-46 header. While the effects of degradation on both materials are insignificant at normal operating currents (10-20 mA), GaAs is, nevertheless, the preferable choice of material in applications where high operating currents or temperatures are expected and long-term reliability is critical.

GaAs offers the second advantage of having lower forward voltage characteristics than GaAlAs. If large numbers of devices are to be placed in series or if power supply voltage is limited, the selection of GaAs over GaAlAs devices may be the best design choice.

## Package Selection

The two broad classifications of package types are hermetic and plastic . Each offers its own distinct advantages. In many demanding environments, hermetic packaging may be mandatory. It has excellent resistance to water and other solvents, while offering the broadest operating temperature range and resistance to thermal shocks. Plastic packaging, in addition to a cost advantage over hermetic packaging, exhibits excellent optical properties. Overall emission efficiency is also superior because optical interfaces are minimized. Finally, resistance to mechanical shock and vibration is excellent because both chip and bond wire are fully encased in supportive material. Application Bulletin 208 compares these package types.

## Special Product Capability

In addition to the standard products shown, Optek leads the industry in custom product capability. Special selections or custom package designs may be the solution to your unique application problem. Call your local Optek office for more information.

**Figure 1.**
**Infrared Emitting Diode Radiation**

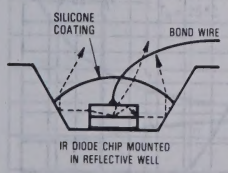
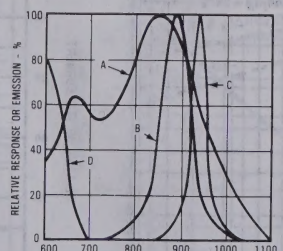
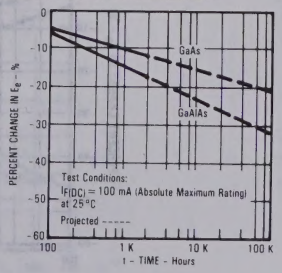



**Figure 2.**
**Photosensor Spectral Response vs. GaAlAs and GaAs**



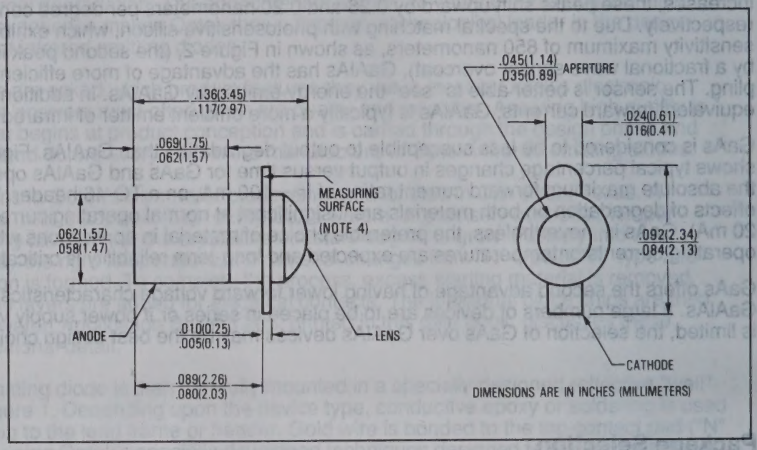

Test Conditions (LED):
$T_A = T_J = 25°C$, $I_F = 100$ mA, DC = 0.1%, PW = 100 µs
Peak Wavelength - $\lambda_p$: (A) XSTR - 850 ± 30 nm
(B) LED GaAlAs - 890 ± 20 nm
(C) LED GaAs - 935 ± 15 nm
(D) Human Eye Response

**Figure 3.**
**Percent Change in GaAs and GaAlAs IR Emitters Mounted in Metal TO-46 Package vs. Time Under Same Conditions**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# GaAs Hermetic Infrared Emitting Diodes
## Types OP123, OP124




### Features

- Miniature hermetically sealed "Pill" package
- Enhanced temperature range
- Ideal for direct mounting to PC boards(1)
- High power output
- Mechanically and spectrally matched to the OP600 phototransistor and the OP300 photodarlington

### Description

The OP123 and OP124 series are high intensity gallium arsenide infrared emitting diodes mounted in miniature "Pill" type hermetically sealed packages. This package style is intended for direct mounting into PC boards.

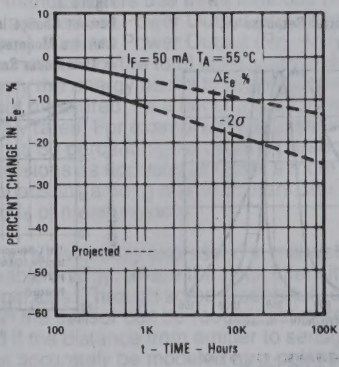
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 100mA |
| Peak Forward Current (2µs pulse width, 0.1% duty cycle) | 1.0A |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Soldering Temperature (5 sec. with soldering iron) | 260°C(1)(2) |
| Power Dissipation | 150mW(3) |

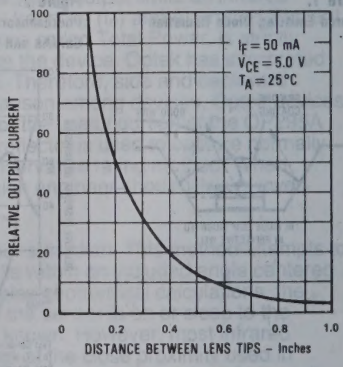
**Notes:**
(1) Refer to Application Bulletin 202 which reviews proper soldering techniques for pill-type devices.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 1.50mW/°C above 25°C.
(4) $E_{e(APT)}$ is measured using a 0.031" (0.787mm) diameter apertured sensor placed 0.50" (12.7mm) from the measuring surface.

**Typical Performance Curves**

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics of OP123 and OP600**



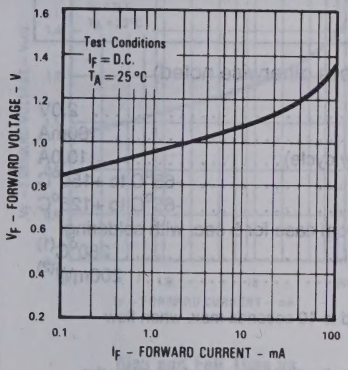
# Types OP123, OP124

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

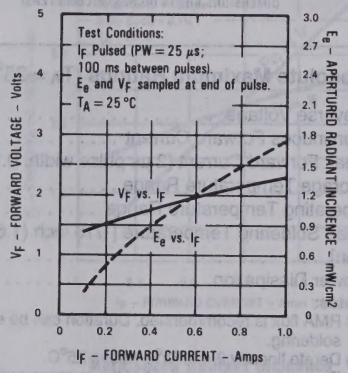
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP123<br>OP124 | 0.40<br>1.00 | | | $mW/cm^2$ | $I_F = 50$ mA[4] |
| $V_F$ | Forward Voltage | | | | 1.50 | V | $I_F = 50$ mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R = 2.0$ V |
| λp | Wavelength at Peak Emission | | | 935 | | nm | $I_F = 50$ mA |
| B | Spectral Bandwidth Between Half Power Points | | | 50 | | nm | $I_F = 50$ mA |
| Δλp/ΔT | Spectral shift with Temperature | | | +0.30 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 24 | | Deg. | $I_F = 50$ mA |
| $t_r$ | Output Rise Time | | | 1000 | | ns | $I_{F(PK)} = 100$ mA, PW = 10.0 µs, D.C. = 10.0% |
| $t_f$ | Output Fall Time | | | 500 | | ns | |

## Typical Performance Curves

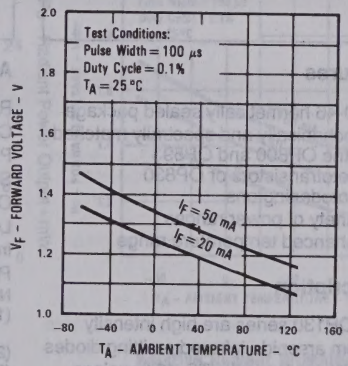
**Forward Voltage vs Forward Current**



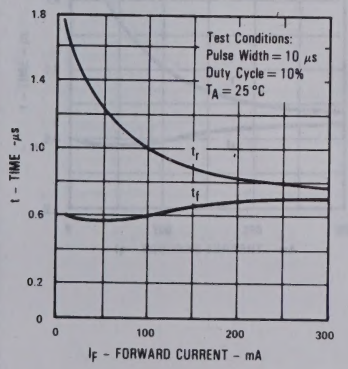

**Forward Voltage and Radiant Incidence vs Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs;
100 ms between pulses).
$E_e$ and $V_F$ sampled at end of pulse.
$T_A$ = 25 °C
$V_F$ vs. $I_F$
$E_e$ vs. $I_F$
$V_F$ - FORWARD VOLTAGE - Volts
$E_e$ - APERTURED RADIANT INCIDENCE - mW/cm²
$I_F$ - FORWARD CURRENT - Amps

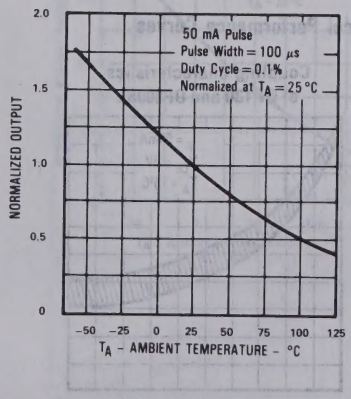
**Forward Voltage vs Ambient Temperature**




**Rise Time and Fall Time vs Forward Current**




**Normalized Power Output vs Ambient Temperature**

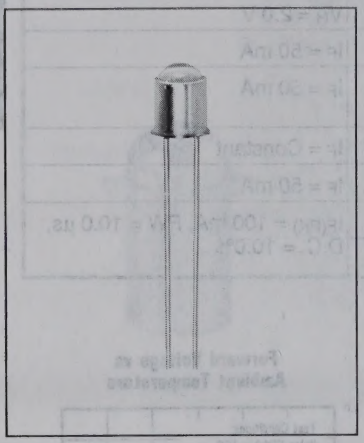


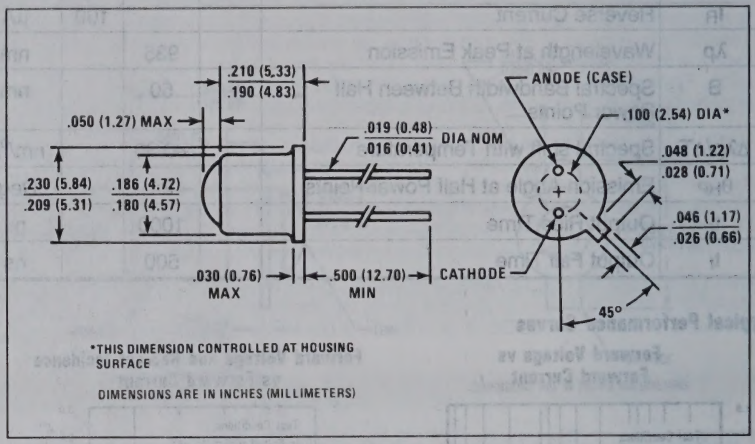



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# GaAs Hermetic Infrared Emitting Diodes
## Types OP130, OP131, OP132, OP133






### Features

- TO-46 hermetically sealed package
- Mechanically and spectrally matched to the OP800 and OP593 phototransistors or OP830 photodarlingtons
- Variety of power ranges
- Enhanced temperature range

### Description

The OP130 series are high intensity gallium arsenide infrared emitting diodes mounted in hermetic TO-46 housings. The narrow beam allows ease of design in beam interrupt applications in conjunction with the OP800 or OP598 series phototransistors. TO-46 housings offer high power dissipation and superior hostile environment operation.

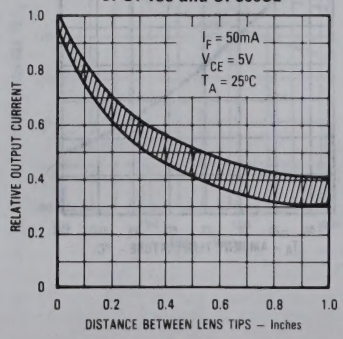
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 100mA |
| Peak Forward Current (2 µs pulse width, 0.1% duty cycle) | 10.0A |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 200mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering.
(2) Derate linearly 2.0 mW/°C above 25°C.
(3) $Ee_{(APT)}$ is a measurement of the average radiant intensity within the cone formed by the measurement surface, a radius of 1.429" (36.30mm) measured from the lens side of the tab to the sensing surface and a sensing surface of 0.250" (6.35mm) in diameter forming a 10° cone. $Ee_{(APT)}$ is not necessarily uniform within the measured area.
(4) Measurement made with 100µs pulse measured at the trailing edge of the pulse with a duty cycle of 0.1% and an $I_F$ = 100mA.

### Typical Performance Curves

**Coupling Characteristics of OP130 and OP800SL**



# Types OP130, OP131, OP132, OP133

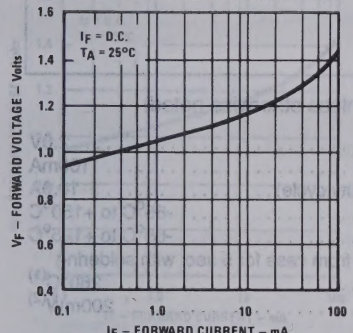
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OP130 | 1.0 | | | mW | $I_F$ = 100 mA(3)(4) |
| | | OP131 | 3.0 | | | mW | $I_F$ = 100 mA(3)(4) |
| | | OP132 | 4.0 | | | mW | $I_F$ = 100 mA(3)(4) |
| | | OP133 | 5.0 | | | mW | $I_F$ = 100 mA(3)(4) |
| $V_F$ | Forward Voltage | | | | 1.75 | V | $I_F$ = 100 mA(4) |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| $\lambda p$ | Wavelength at Peak Emission | | | 935 | | nm | $I_F$ = 10 mA(4) |
| B | Spectral Bandwidth Between Half Power Points | | | 50 | | nm | $I_F$ = 10 mA(4) |
| $\Delta\lambda p/\Delta T$ | Spectral Shift with Temperature | | | +0.30 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 18 | | Deg. | $I_F$ = 100 mA |
| $t_r$ | Output Rise Time | | | 1000 | | ns | $I_{F(PK)}$ = 100 mA, |
| $t_f$ | Output Fall Time | | | 500 | | ns | PW = 10µs, D.C. = 10% |

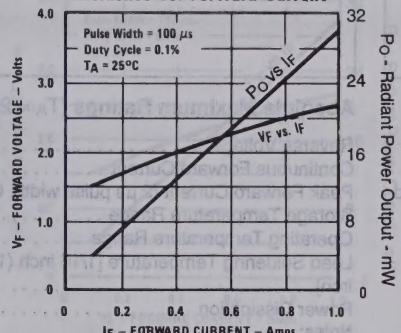


## Typical Performance Curves

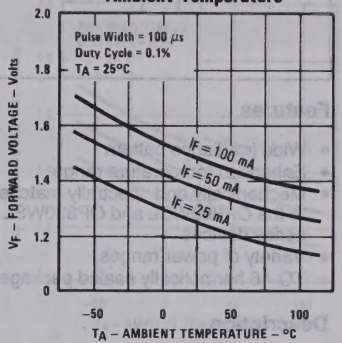
**Forward Voltage vs. Forward Current**



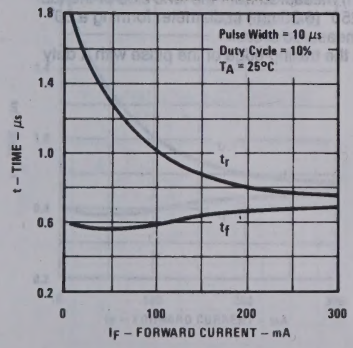

**Forward Voltage and Radiant Incidence vs. Forward Current**


Pulse Width = 100 µs
Duty Cycle = 0.1%
TA = 25°C
PO vs IF
VF vs. IF
VF – FORWARD VOLTAGE – Volts
PO - Radiant Power Output - mW
IF – FORWARD CURRENT – Amps

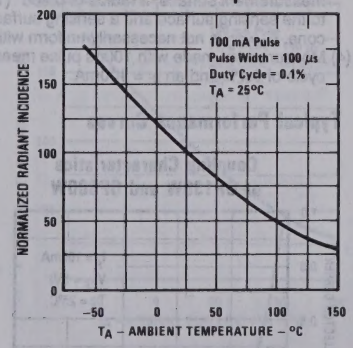
**Forward Voltage vs. Ambient Temperature**



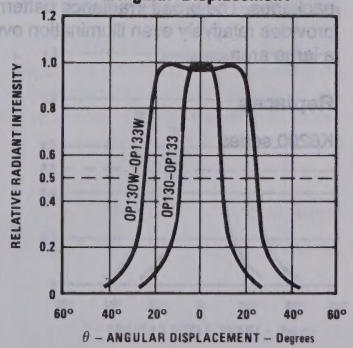

**Rise and Fall Time vs. Forward Current**




**Normalized Radiant Incidence vs. Ambient Temperature**



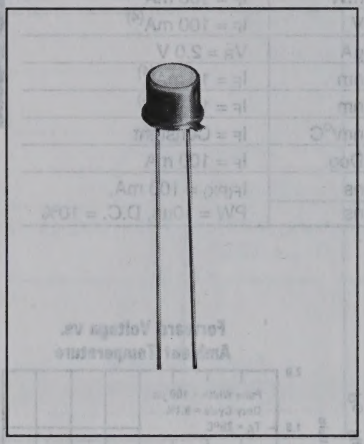

**Relative Radiant Intensity vs. Angular Displacement**

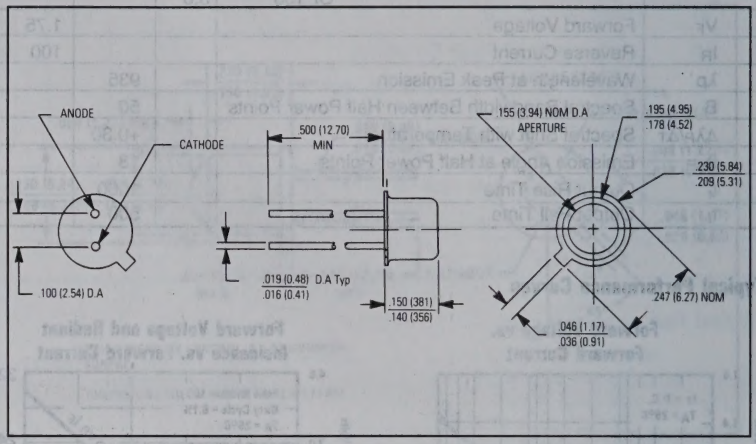



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# GaAs Hermetic Infrared Emitting Diodes
## Types OP130W, OP131W, OP132W, OP133W






### Features

- Wide irradiance pattern
- Enhanced temperature range
- Mechanically and spectrally matched to the OP800WSL and OP830WSL series devices
- Variety of power ranges
- TO-46 hermetically sealed package

### Description

The OP130W series devices are 935nm gallium arsenide infrared emitting diodes mounted in hermetically sealed packages. The broad irradiance pattern provides relatively even illumination over a large area.

### Replaces

K6200 series

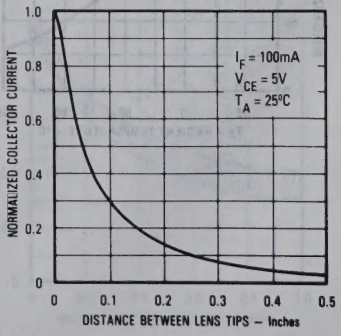
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 100mA |
| Peak Forward Current (2 µs pulse width, 0.1% duty cycle) | 10.0A |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 200mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering.
(2) Derate linearly 2.0mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average radiant intensity within the cone formed by the measurement surface, a radius of 0.466" (11.84mm) measured from the lens side of the tab to the sensing surface and a sensing surface of 0.250" (6.35mm) in diameter forming a 30° cone. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(4) Measurement made with 100µs pulse measured at the trailing edge of the pulse with a duty cycle of 0.1% and an $I_F$ = 100mA.

### Typical Performance Curves

**Coupling Characteristics of OP130W and OP800W**



# Types OP130W, OP131W, OP132W, OP133W

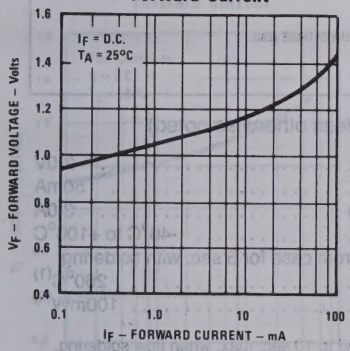
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OP130W | 1.0 | | | mW | $I_F$ = 100 mA(3)(4) |
| | | OP131W | 3.0 | | | mW | $I_F$ = 100 mA(3)(4) |
| | | OP132W | 4.0 | | | mW | $I_F$ = 100 mA(3)(4) |
| | | OP133W | 5.0 | | | mW | $I_F$ = 100 mA(3)(4) |
| $V_F$ | Forward Voltage | | | | 1.75 | V | $I_F$ = 100 mA(3)(4) |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| λp | Wavelength at Peak Emission | | | 935 | | nm | $I_F$ = 10 mA(3) |
| B | Spectral Bandwidth Half Power Points | | | 50 | | nm | $I_F$ = 10 mA(3) |
| $\Delta\lambda_P/\Delta T$ | Spectral Shift with Temperature | | | +0.30 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 50 | | Deg. | $I_F$ = 100 mA |
| $t_r$ | Output Rise Time | | | 1000 | | ns | $I_{F(PK)}$ = 100 mA, |
| $t_f$ | Output Fall Time | | | 500 | | ns | PW = 10µs, D.C. = 10% |

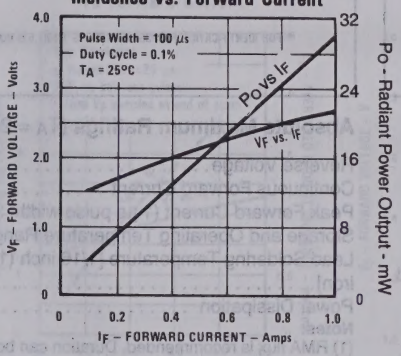


## Typical Performance Curves

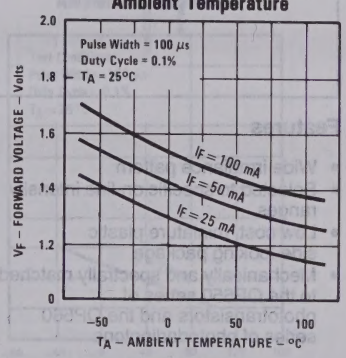
**Forward Voltage vs. Forward Current**



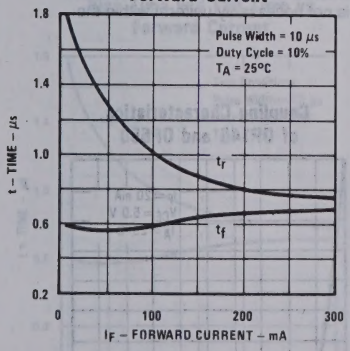

**Forward Voltage and Radiant Incidence vs. Forward Current**


Pulse Width = 100 µs
Duty Cycle = 0.1%
TA = 25°C
PO vs IF
VF vs. IF
VF – FORWARD VOLTAGE – Volts
PO – Radiant Power Output - mW
IF – FORWARD CURRENT – Amps

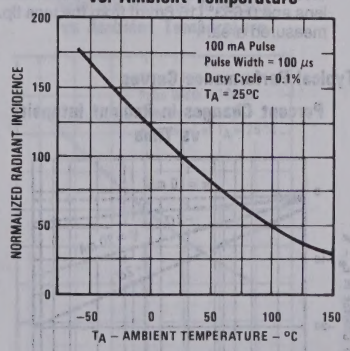
**Forward Voltage vs. Ambient Temperature**



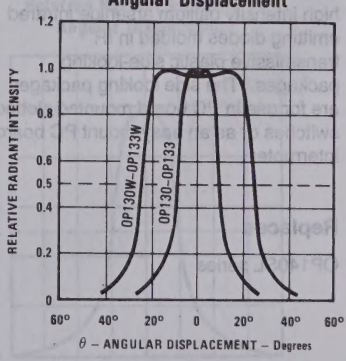

**Rise and Fall Time vs. Forward Current**




**Normalized Radiant Incidence vs. Ambient Temperature**

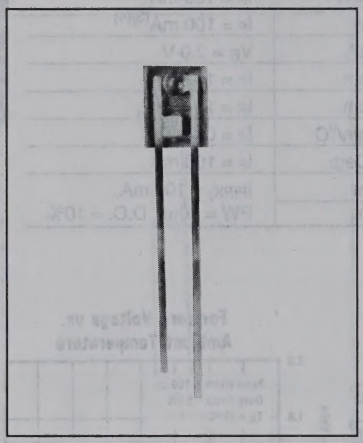


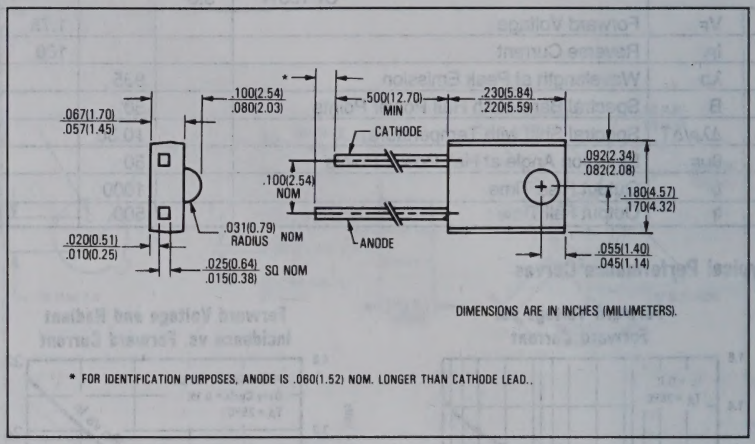

**Relative Radiant Intensity vs. Angular Displacement**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# GaAs Plastic Infrared Emitting Diodes
## Types OP140A, OP140B, OP140C, OP140D






### Features

- Wide irradiance pattern
- Selected to specific on-line intensity ranges
- Low cost, miniature plastic side-looking package
- Mechanically and spectrally matched to the OP550 series of phototransistors and the OP560 series of photodarlingtons

### Description

The OP140 series devices are 935nm high intensity gallium arsenide infrared emitting diodes molded in IR transmissive plastic side-looking packages. The side looking packages are for use in PC board mounted slotted switches or as an easy mount PC board interrupter.

### Replaces

OP140SL series

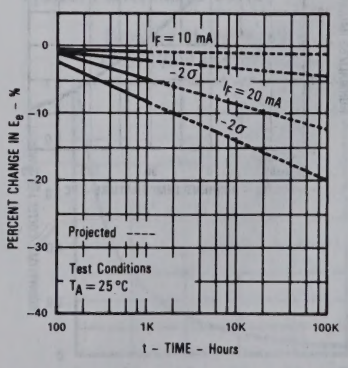
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

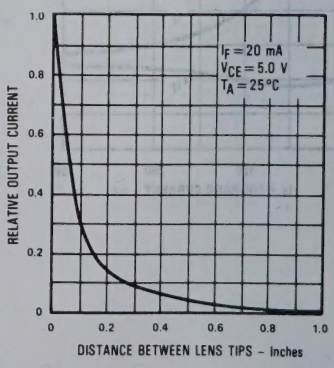
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.180" (4.57mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 0.653" (16.6mm) from the lens tip. $E_{e(APT)}$ is not necessarily uniform within the measured area.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics of OP140 and OP550**



# Types OP140A, OP140B, OP140C, OP140D

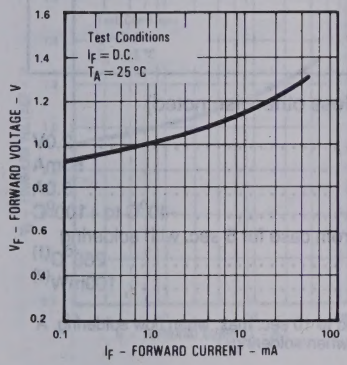
**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP140D | 0.10 | | | $mW/cm^2$ | $I_F = 20$ mA(3) |
| | | OP140C | 0.20 | | 0.40 | $mW/cm^2$ | $I_F = 20$ mA(3) |
| | | OP140B | 0.30 | | 0.55 | $mW/cm^2$ | $I_F = 20$ mA(3) |
| | | OP140A | 0.40 | | | $mW/cm^2$ | $I_F = 20$ mA(3) |
| $V_F$ | Forward Voltage | | | | 1.60 | V | $I_F = 20$ mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R = 2.0$ V |
| λp | Wavelength at Peak Emission | | | 935 | | nm | $I_F = 10$ mA |
| B | Spectral Bandwidth Between Half Power Points | | | 50 | | nm | $I_F = 10$ mA |
| $\Delta\lambda p/\Delta T$ | Spectral Shift with Temperature | | | +0.30 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 40 | | Deg. | $I_F = 20$ mA |
| $t_r$ | Output Rise Time | | | 1000 | | ns | $I_{F(PK)}$ =100 mA, |
| $t_f$ | Output Fall Time | | | 500 | | ns | PW = 10.0µs, D.C.=10.0% |

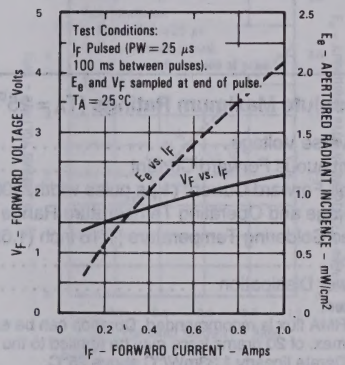


## Typical Performance Curves

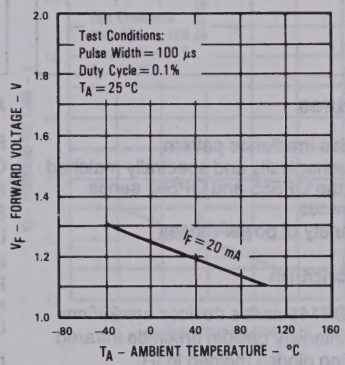
**Forward Voltage vs Forward Current**



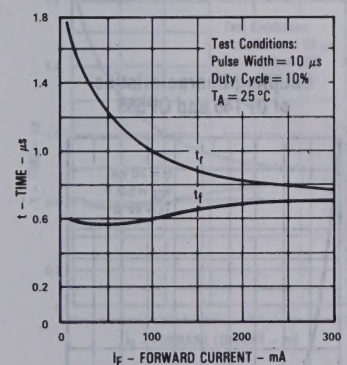

**Forward Voltage and Radiant Incidence vs Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs
100 ms between pulses).
$E_e$ and $V_F$ sampled at end of pulse.
$T_A$ = 25 °C
$E_e$ vs. $I_F$
$V_F$ vs. $I_F$
$V_F$ – FORWARD VOLTAGE – Volts
$E_e$ – APERTURED RADIANT INCIDENCE – mW/cm²
$I_F$ – FORWARD CURRENT – Amps

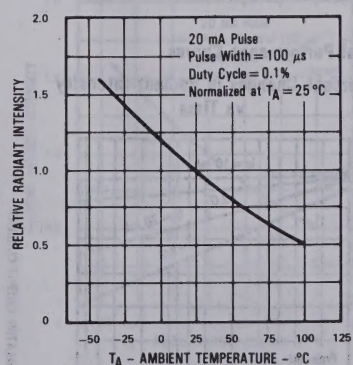
**Forward Voltage vs Ambient Temperature**



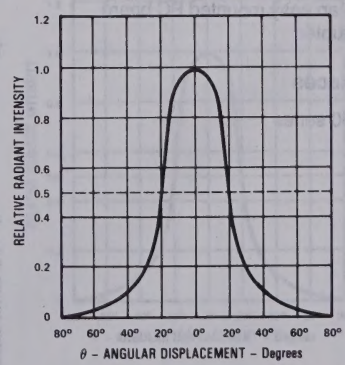

**Rise Time and Fall Time vs Forward Current**




**Relative Radiant Intensity vs Ambient Temperature**



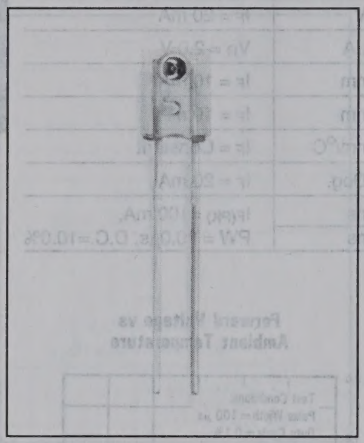

**Relative Radiant Intensity vs Angular Displacement**

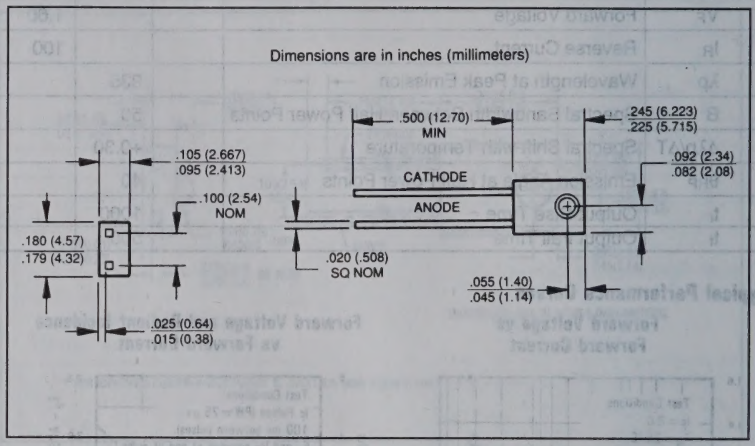



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

# GaAs Plastic Infrared Emitting Diodes
## Types OP145A, OP145B, OP145C, OP145D






### Features

- Wide irradiance pattern
- Mechanically and spectrally matched to the OP555 and OP565 series devices
- Variety of power ranges

### Description

The OP145 series devices are 935nm high intensity gallium arsenide infrared emitting diodes molded in IR transmissive amber tinted epoxy packages. The side-looking packages are for use in PC board slotted switches or as an easy mounted PC board interrupter.

### Replaces

K6550 series

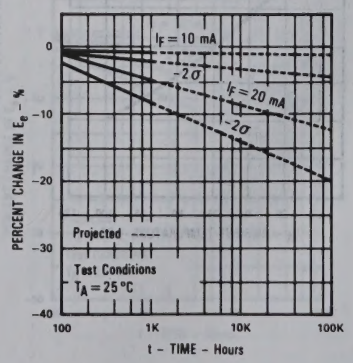
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

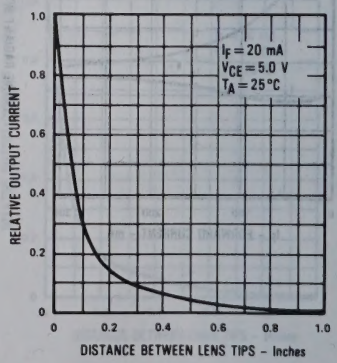
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.180" (4.57mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.653" (16.6mm) from the lens tip. $E_{e(APT)}$ is not necessarily uniform within the measured area.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics of OP145 and OP555**



# Types OP145A, OP145B, OP145C, OP145D

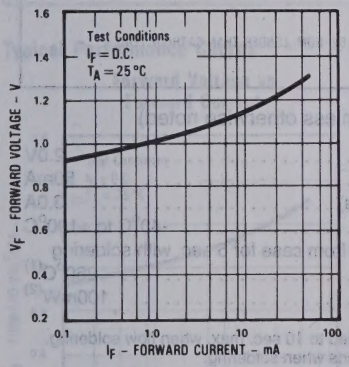
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP145D | 0.10 | | | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP145C | 0.20 | | 0.40 | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP145B | 0.30 | | 0.55 | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP145A | 0.40 | | | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| $V_F$ | Forward Voltage | | | | 1.60 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| λp | Wavelength at Peak Emission | | | 935 | | nm | $I_F$ = 10 mA |
| B | Spectral Bandwidth Between Half Power Points | | | 50 | | nm | $I_F$ = 10mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.30 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 40 | | Deg. | $I_F$ = 20mA |
| $t_r$ | Output Rise Time | | | 1000 | | ns | $I_{F(PK)}$ = 100 mA, |
| $t_f$ | Output Fall Time | | | 500 | | ns | PW = 10 µs, D.C. = 10.0% |

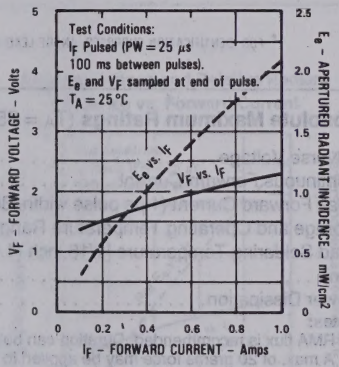


## Typical Performance Curves

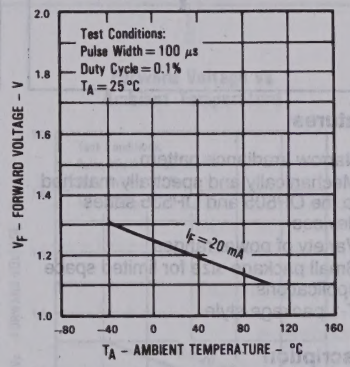
**Forward Voltage vs Forward Current**



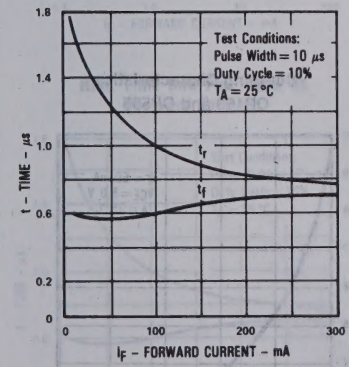

**Forward Voltage and Radiant Incidence vs Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs
100 ms between pulses).
$E_e$ and $V_F$ sampled at end of pulse.
$T_A$ = 25 °C
$E_e$ vs. $I_F$
$V_F$ vs. $I_F$
$V_F$ – FORWARD VOLTAGE – Volts
$E_e$ – APERTURED RADIANT INCIDENCE – mW/cm2
$I_F$ – FORWARD CURRENT – Amps

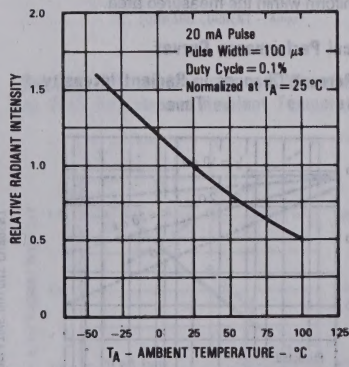
**Forward Voltage vs Ambient Temperature**



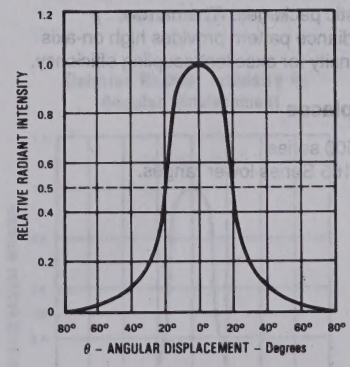

**Rise Time and Fall Time vs Forward Current**




**Relative Radiant Intensity vs Ambient Temperature**



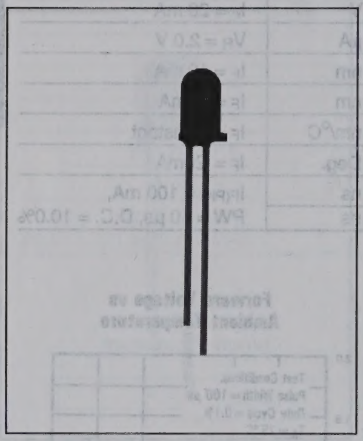

**Relative Radiant Intensity vs Angular Displacement**

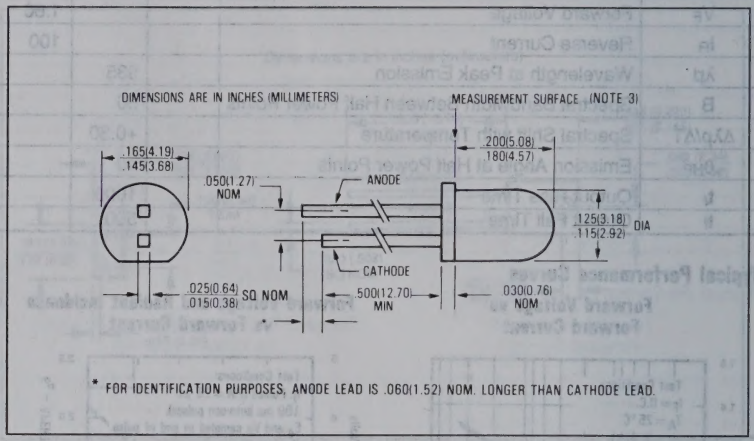



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# GaAs Plastic Infrared Emitting Diodes
## Types OP163A, OP163B, OP163C, OP163D






### Features

- Narrow irradiance pattern
- Mechanically and spectrally matched to the OP505 and OP535 series devices
- Variety of power ranges
- Small package size for limited space applications
- T-1 package style

### Description

The OP163 series devices are 935nm gallium arsenide infrared emitting diodes molded in IR transmissive black tinted plastic packages. The narrow irradiance pattern provides high on-axis intensity for excellent coupling efficiency.

### Replaces

K6500 series
OP165 Series lower ranges.

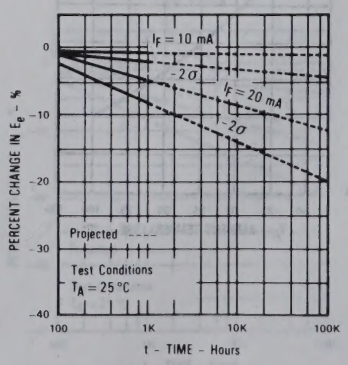
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

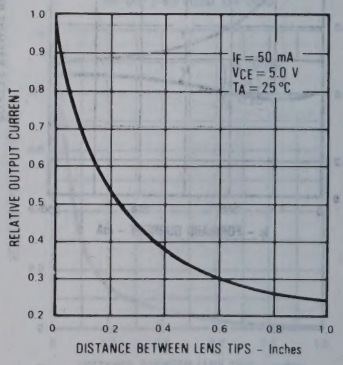
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.081" (2.06mm) in diameter, perpendicular to, and centered on, the mechanical axis of the lens and 0.590" (14.99mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics OP163 and OP505**



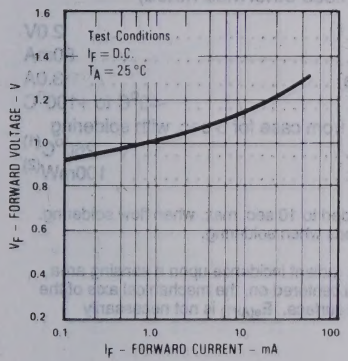
# Types OP163A, OP163B, OP163C, OP163D

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

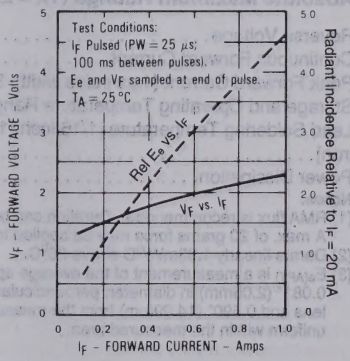
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP163D | 0.28 | | | | |
| | | OP163C | 0.85 | | 1.60 | mW/cm$^2$ | $I_F$ = 20 mA[3] |
| | | OP163B | 1.40 | | 2.20 | | |
| | | OP163A | 1.40 | | | | |
| $V_F$ | Forward Voltage | | | | 1.60 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| λp | Wavelength at Peak Emission | | | 935 | | nm | $I_F$ = 10 mA |
| B | Spectral Bandwidth Between Half Power Points | | | 50 | | nm | $I_F$ = 10 mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.30 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 18 | | Deg. | $I_F$ = 20 mA |
| $t_r$ | Output Rise Time | | | 1000 | | ns | $I_{F(PK)}$ = 100 mA, PW = 10.0 µs, D.C. = 10.0% |
| $t_f$ | Output Fall Time | | | 500 | | ns | |

## Typical Performance Curves

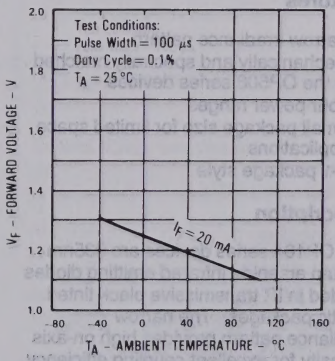
**Forward Voltage vs Forward Current**



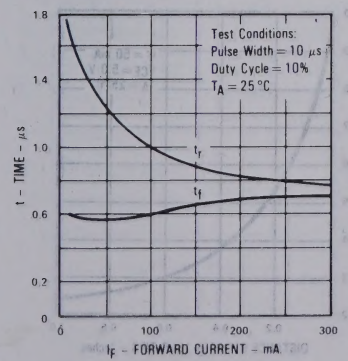

**Forward Voltage and Relative Radiant Incidence vs. Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs;
100 ms between pulses).
$E_e$ and $V_F$ sampled at end of pulse.
$T_A$ = 25 °C
Rel $E_e$ vs. $I_F$
$V_F$ vs. $I_F$
$V_F$ - FORWARD VOLTAGE - Volts
Radiant Incidence Relative to $I_F$ = 20 mA
$I_F$ - FORWARD CURRENT - Amps

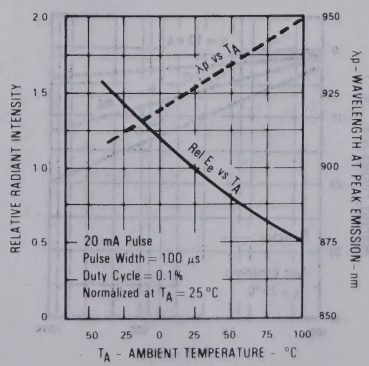
**Forward Voltage vs Ambient Temperature**



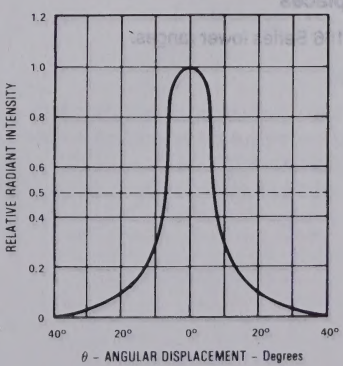

**Rise Time and Fall Time vs Forward Current**




**Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature**


λp vs $T_A$
Rel $E_e$ vs $T_A$
20 mA Pulse
Pulse Width = 100 µs
Duty Cycle = 0.1%
Normalized at $T_A$ = 25 °C
RELATIVE RADIANT INTENSITY
λp - WAVELENGTH AT PEAK EMISSION - nm
$T_A$ - AMBIENT TEMPERATURE - °C

**Relative Radiant Intensity vs Angular Displacement**





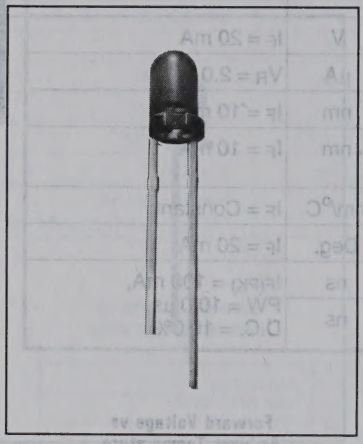

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

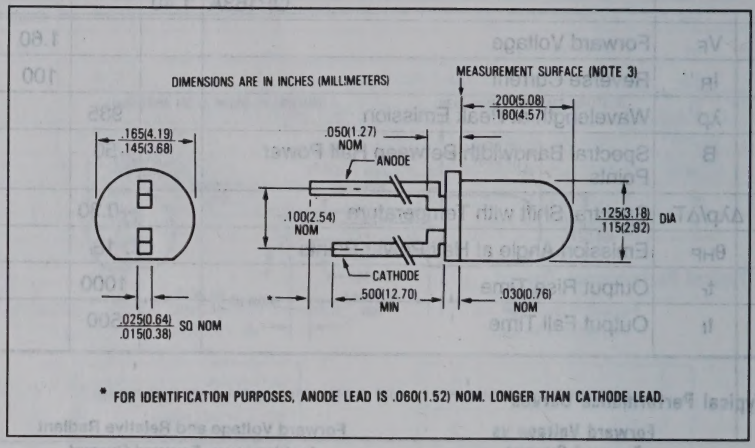
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# GaAs Plastic Infrared Emitting Diodes

## Types OP164A, OP164B, OP164C, OP164D






### Features

- Narrow irradiance pattern
- Mechanically and spectrally matched to the OP506 series devices
- Four power ranges
- Small package size for limited space applications
- T-1 package style

### Description

The OP164 series devices are 935nm gallium arsenide infrared emitting diodes molded in IR transmissive black tinted plastic packages. The narrow irradiance pattern provides high on-axis intensity for excellent coupling efficiency. Lead spacing is 0.100" (2.54mm) to facilitate soldering processes.

### Replaces

OP166 Series lower ranges.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

**Notes:**

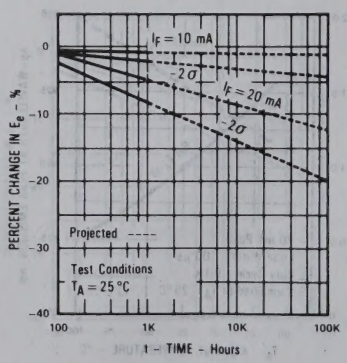
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.

(2) Derate linearly 1.33mW/°C above 25°C.

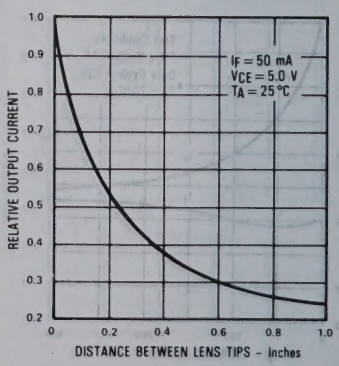
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.081" (2.06mm) in diameter, perpendicular to, and centered on, the mechanical axis of the lens and 0.590" (14.99mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics OP164 and OP506**



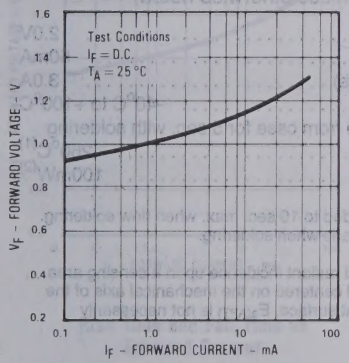
# Types OP164A, OP164B, OP164C, OP164D

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

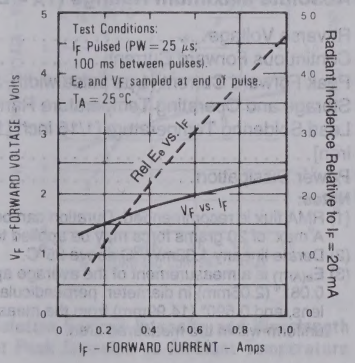
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP164D | 0.28 | | | | |
| | | OP164C | 0.85 | | 1.60 | mW/cm² | $I_F$ = 20 mA(3) |
| | | OP164B | 1.40 | | 2.20 | | |
| | | OP164A | 1.40 | | | | |
| $V_F$ | Forward Voltage | | | | 1.60 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| λp | Wavelength at Peak Emission | | | 935 | | nm | $I_F$ = 10 mA |
| B | Spectral Bandwidth Between Half Power Points | | | 50 | | nm | $I_F$ = 10 mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.30 | | nm/°C | $I_F$ = Constant |
| θHP | Emission Angle at Half Power Points | | | 18 | | Deg. | $I_F$ = 20 mA |
| $t_r$ | Output Rise Time | | | 1000 | | ns | $I_{F(PK)}$ = 100 mA, PW = 10.0 µs, D.C. = 10.0% |
| $t_f$ | Output Fall Time | | | 500 | | ns | |

## Typical Performance Curves

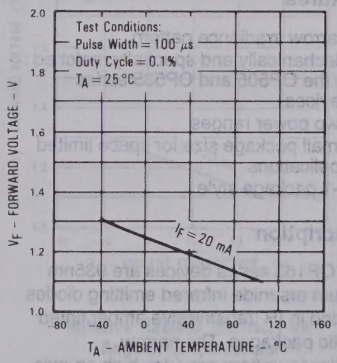
**Forward Voltage vs Forward Current**



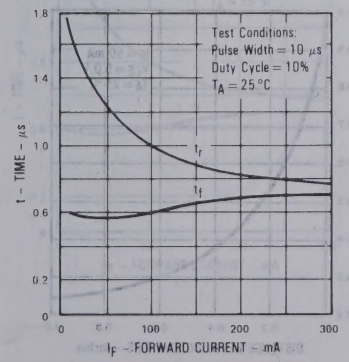

**Forward Voltage and Relative Radiant Incidence vs. Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs;
100 ms between pulses).
$E_e$ and $V_F$ sampled at end of pulse.
$T_A$ = 25 °C
Rel $E_e$ vs. $I_F$
$V_F$ vs. $I_F$
$V_F$ - FORWARD VOLTAGE - Volts
Radiant Incidence Relative to $I_F$ = 20 mA
$I_F$ - FORWARD CURRENT - Amps

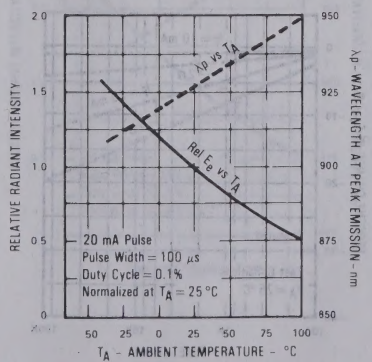
**Forward Voltage vs Ambient Temperature**



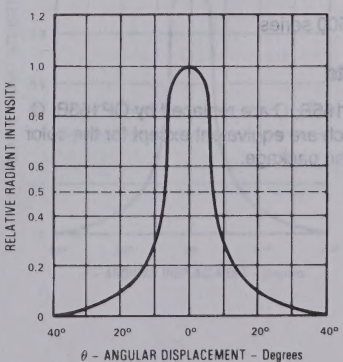

**Rise Time and Fall Time vs Forward Current**




**Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature**

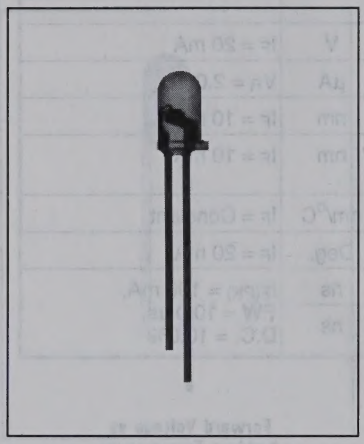

λp vs $T_A$
Rel $E_e$ vs $T_A$
20 mA Pulse
Pulse Width = 100 µs
Duty Cycle = 0.1%
Normalized at $T_A$ = 25 °C
RELATIVE RADIANT INTENSITY
λp - WAVELENGTH AT PEAK EMISSION - nm
$T_A$ - AMBIENT TEMPERATURE - °C

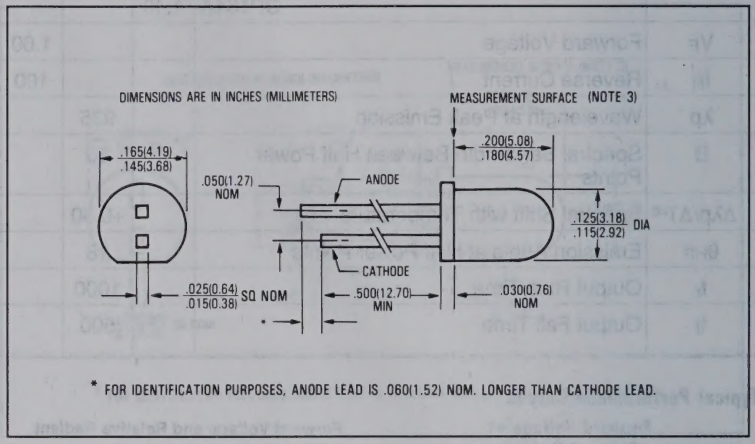
**Relative Radiant Intensity vs Angular Displacement**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# GaAs Plastic Infrared Emitting Diodes
## Types OP165A, OP165D






### Features

- Narrow irradiance pattern
- Mechanically and spectrally matched to the OP505 and OP535 series devices
- Two power ranges
- Small package size for space limited applications
- T-1 package style

### Description

The OP165 series devices are 935nm gallium arsenide infrared emitting diodes molded in IR transmissive amber tinted plastic packages. The narrow irradiance pattern provides high on-axis intensity for excellent coupling efficiency.

### Replaces

K6500 series

### Note

OP165B, C are replaced by OP163B, C which are equivalent except for the color of the package.

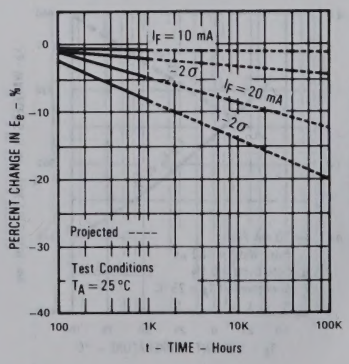
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

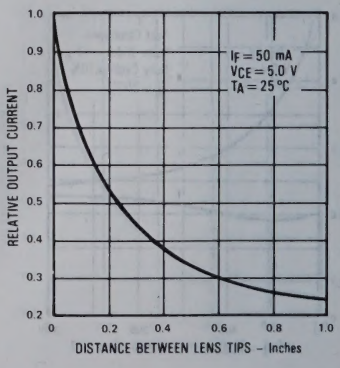
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.081" (2.06mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.590" (14.99mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics OP165 and OP505**



# Types OP165A, OP165D

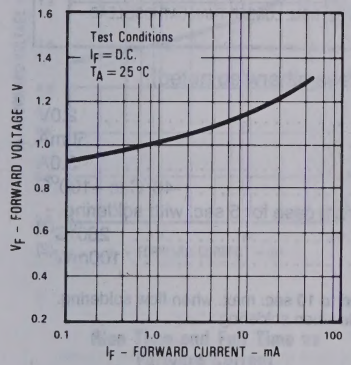
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP165D | 1.40 | | | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP165A | 1.95 | | 3.70 | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| $V_F$ | Forward Voltage | | | | 1.60 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| λp | Wavelength at Peak Emission | | | 935 | | nm | $I_F$ = 10 mA |
| B | Spectral Bandwidth Between Half Power Points | | | 50 | | nm | $I_F$ = 10 mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.30 | | nm/°C | $I_F$ = Constant |
| θHP | Emission Angle at Half Power Points | | | 18 | | Deg. | $I_F$ = 20 mA |
| $t_r$ | Output Rise Time | | | 1000 | | ns | $I_{F(PK)}$ = 100 mA, PW = 10 µs, D.C. = 10% |
| $t_f$ | Output Fall Time | | | 500 | | ns | |

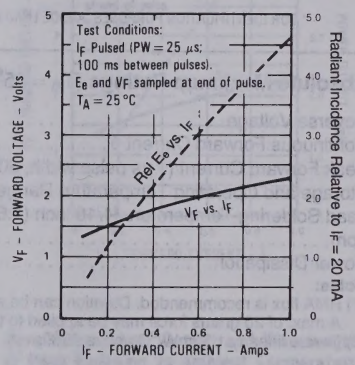


## Typical Performance Curves

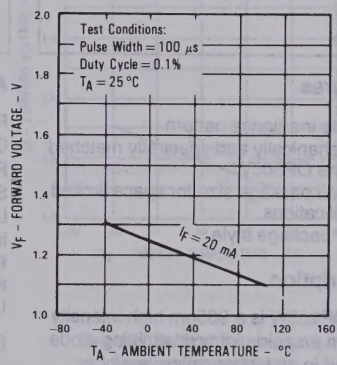
**Forward Voltage vs Forward Current**



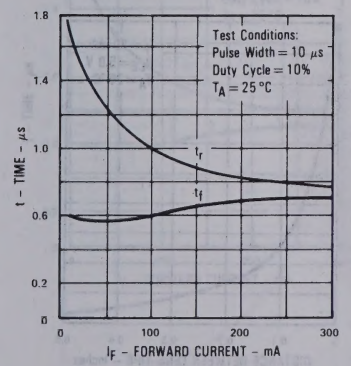

**Forward Voltage and Relative Radiant Incidence vs. Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs;
100 ms between pulses).
$E_e$ and $V_F$ sampled at end of pulse.
$T_A$ = 25 °C
Rel $E_e$ vs. $I_F$
$V_F$ vs. $I_F$
$V_F$ - FORWARD VOLTAGE - Volts
Radiant Incidence Relative to $I_F$ = 20 mA
$I_F$ - FORWARD CURRENT - Amps

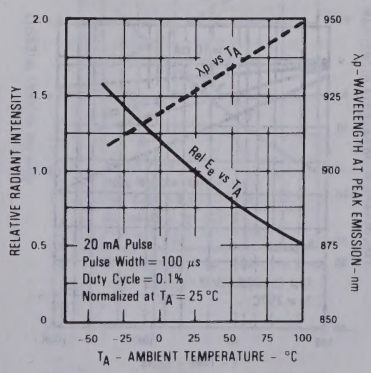
**Forward Voltage vs Ambient Temperature**



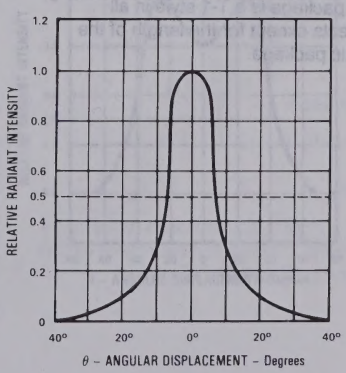

**Rise Time and Fall Time vs Forward Current**




**Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature**


λp vs $T_A$
Rel $E_e$ vs $T_A$
20 mA Pulse
Pulse Width = 100 µs
Duty Cycle = 0.1%
Normalized at $T_A$ = 25 °C
RELATIVE RADIANT INTENSITY
λp - WAVELENGTH AT PEAK EMISSION - nm
$T_A$ - AMBIENT TEMPERATURE - °C

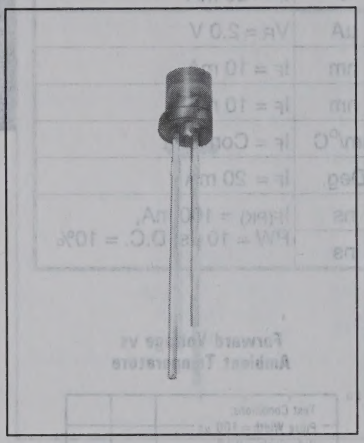
**Relative Radiant Intensity vs Angular Displacement**

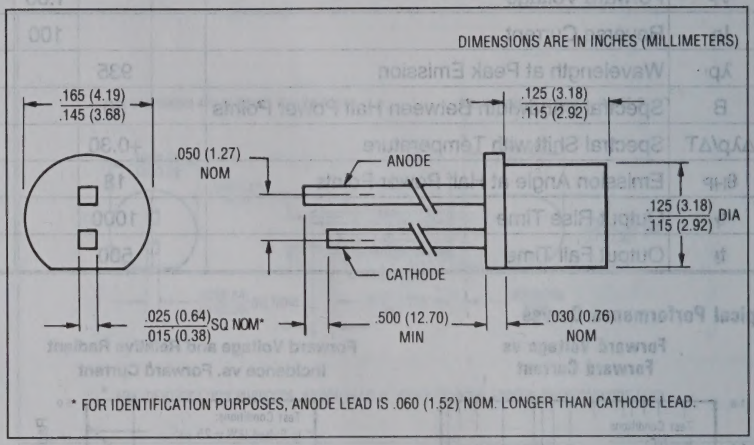



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# GaAs Plastic Infrared Emitting Diode
## Type OP165W






### Features

- Wide irradiance pattern
- Mechanically and spectrally matched to the OP505W
- Small package size for space limited applications
- T-1 package style

### Description

The OP165W is a 935nm high intensity gallium arsenide infrared emitting diode molded in an IR transmissive amber tinted epoxy package. The broad irradiance pattern provides relatively even illumination over a large area. This package is a T-1 style in all respects except for the length of the plastic package.

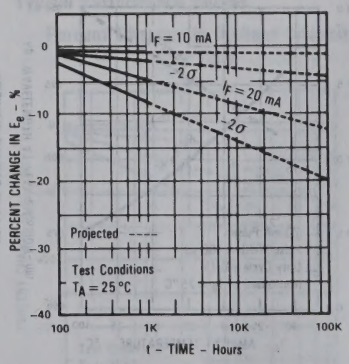
### Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

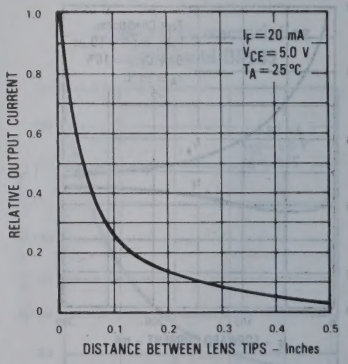
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.

### Typical Performance Curves

**Percent Changes in Power Output vs Time**




**Coupling Characteristics of OP165W and OP505W**



# Type OP165W

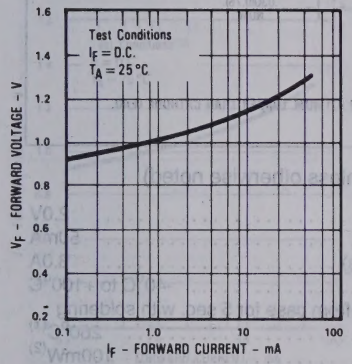
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | 0.50 | | | mW | $I_F$ = 20 mA |
| $V_F$ | Forward Voltage | | | 1.60 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0 V |
| $\lambda p$ | Wavelength at Peak Emission | | 935 | | nm | $I_F$ = 10 mA |
| B | Spectral Bandwidth Between Half Power Points | | 50 | | nm | $I_F$ = 10 mA |
| $\Delta\lambda p/\Delta T$ | Spectral Shift with Temperature | | +0.30 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | 90 | | Deg. | $I_F$ = 20 mA |
| $t_r$ | Output Rise Time | | 1000 | | ns | $I_{F(PK)}$ = 100 mA, |
| $t_f$ | Output Fall Time | | 500 | | ns | PW = 10 µs, D.C. = 10.0% |

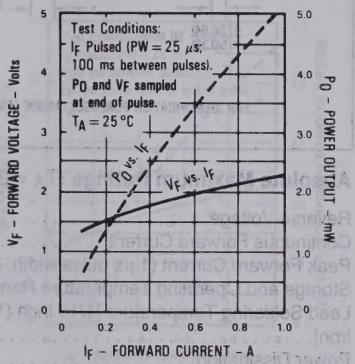


## Typical Performance Curves

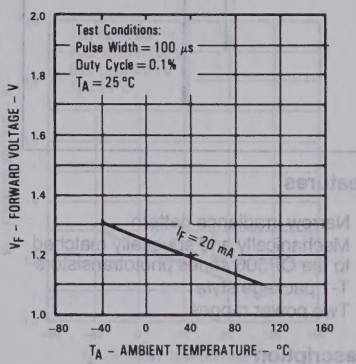
**Forward Voltage vs Forward Current**



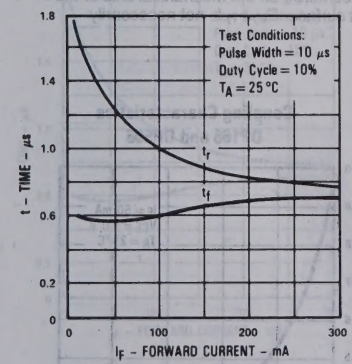

**Forward Voltage and Power Output vs Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs; 100 ms between pulses).
$P_O$ and $V_F$ sampled at end of pulse.
$T_A$ = 25 °C
$P_O$ vs. $I_F$
$V_F$ vs. $I_F$
$V_F$ - FORWARD VOLTAGE - Volts
$P_O$ - POWER OUTPUT - mW
$I_F$ - FORWARD CURRENT - A

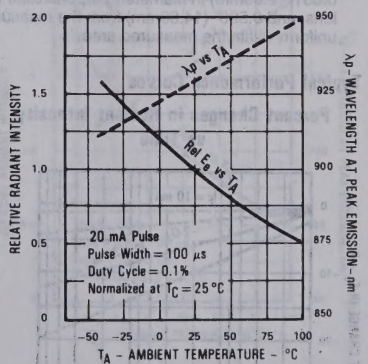
**Forward Voltage vs Ambient Temperature**



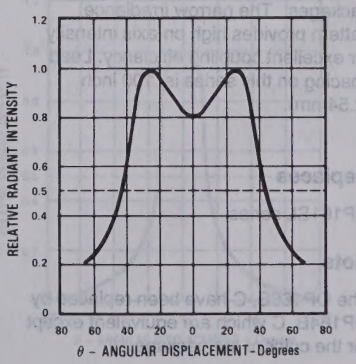

**Rise Time and Fall Time vs Forward Current**




**Normalized Power Output and Wavelength at Peak Emission vs Ambient Temperature**


$\lambda p$ vs $T_A$
Rel $E_e$ vs $T_A$
20 mA Pulse
Pulse Width = 100 µs
Duty Cycle = 0.1%
Normalized at $T_C$ = 25 °C
RELATIVE RADIANT INTENSITY
$\lambda p$ - WAVELENGTH AT PEAK EMISSION - nm
$T_A$ - AMBIENT TEMPERATURE - °C

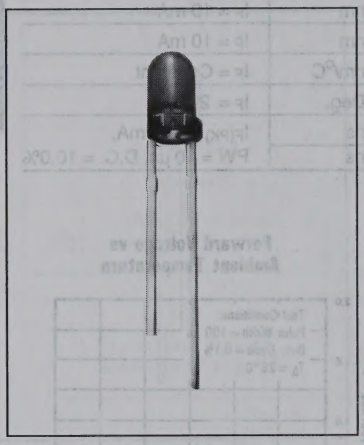
**Relative Radiant Intensity vs Angular Displacement**

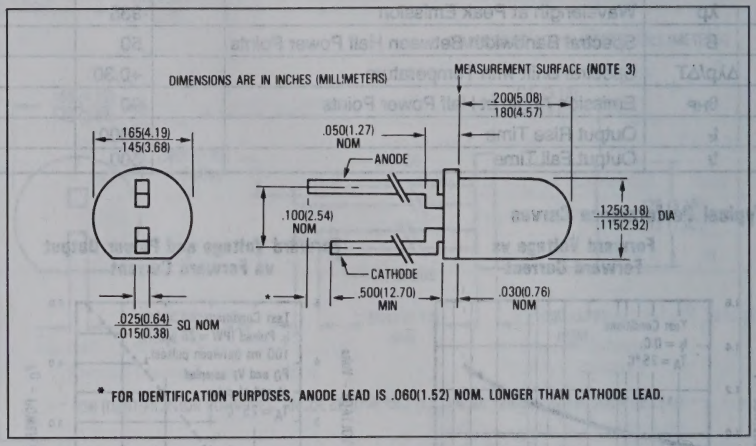



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# GaAs Plastic Infrared Emitting Diodes
## Types OP166A, OP166D






### Features

- Narrow irradiance pattern
- Mechanically and spectrally matched to the OP506 series phototransistors
- T-1 package style
- Two power ranges

### Description

The OP166 series devices are 935nm high intensity gallium arsenide infrared emitting diodes molded in IR transmissive amber tinted epoxy packages. The narrow irradiance pattern provides high on-axis intensity for excellent coupling efficiency. Lead spacing on this series is .100 inch (2.54mm).

### Replaces

OP161SL series

### Note

The OP166B, C have been replaced by OP164B, C which are equivalent except for the color of the package.

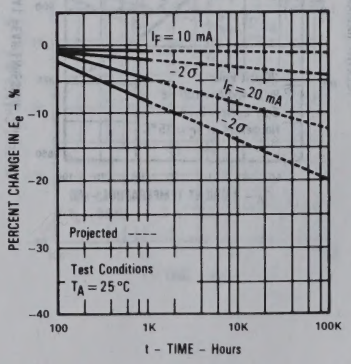
### Absolute Maximum Ratings ($T_A = 25^{\circ}C$ unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

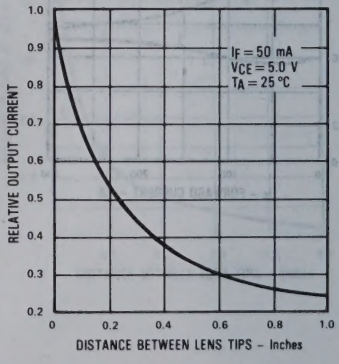
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.081" (2.06mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.590" (14.99mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics OP166 and OP506**



# Types OP166A, OP166D

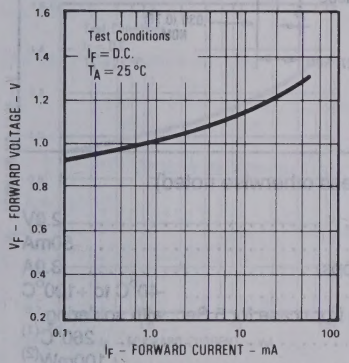
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP166D | 1.40 | | | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP166A | 1.95 | | 3.70 | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| $V_F$ | Forward Voltage | | | | 1.60 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| $\lambda p$ | Wavelength at Peak Emission | | | 935 | | nm | $I_F$ = 10 mA |
| B | Spectral Bandwidth Between Half Power Points | | | 50 | | nm | $I_F$ = 10 mA |
| $\Delta\lambda p/\Delta T$ | Spectral Shift with Temperature | | | +0.30 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 18 | | Deg. | $I_F$ = 20 mA |
| $t_r$ | Output Rise Time | | | 1000 | | ns | $I_{F(PK)}$ = 100 mA, |
| $t_f$ | Output Fall Time | | | 500 | | ns | PW = 10µs, D.C. = 10.0% |

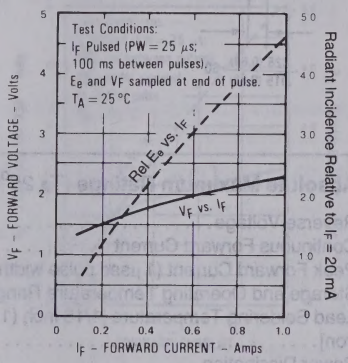


## Typical Performance Curves

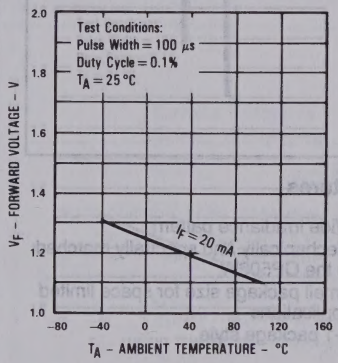
**Forward Voltage vs Forward Current**



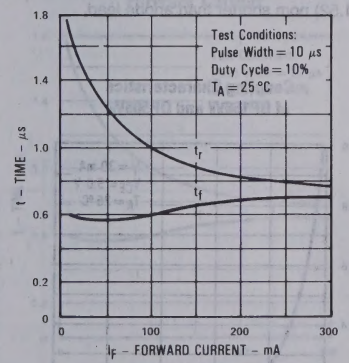

**Forward Voltage and Relative Radiant Incidence vs. Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs;
100 ms between pulses).
$E_e$ and $V_F$ sampled at end of pulse.
$T_A$ = 25 °C
Rel $E_e$ vs. $I_F$
$V_F$ vs. $I_F$
$V_F$ – FORWARD VOLTAGE – Volts
Radiant Incidence Relative to $I_F$ = 20 mA
$I_F$ – FORWARD CURRENT – Amps

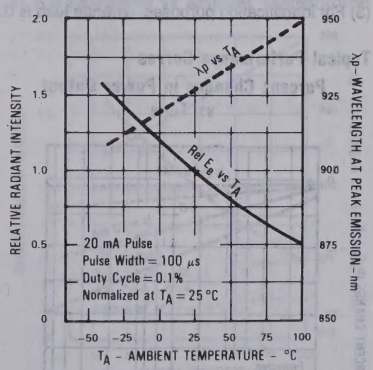
**Forward Voltage vs Ambient Temperature**



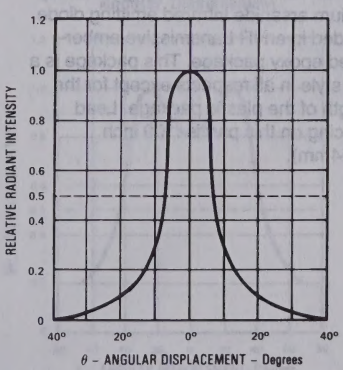

**Rise Time and Fall Time vs Forward Current**




**Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature**

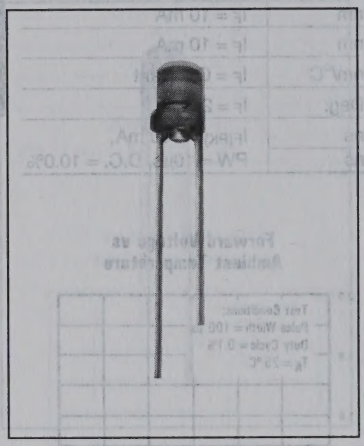

λp vs $T_A$
Rel $E_e$ vs $T_A$
20 mA Pulse
Pulse Width = 100 µs
Duty Cycle = 0.1%
Normalized at $T_A$ = 25 °C
RELATIVE RADIANT INTENSITY
λp – WAVELENGTH AT PEAK EMISSION – nm
$T_A$ – AMBIENT TEMPERATURE – °C

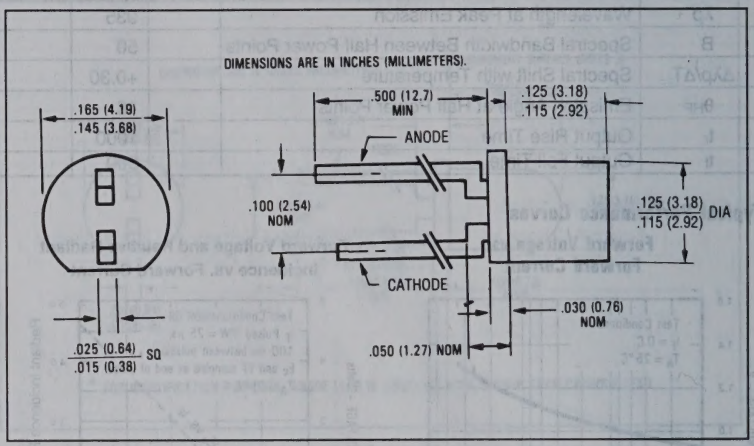
**Relative Radiant Intensity vs Angular Displacement**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# GaAs Plastic Infrared Emitting Diode
## Type OP166W






### Features

- Wide irradiance pattern
- Mechanically and spectrally matched to the OP506W
- Small package size for space limited applications
- T-1 package style

### Description

The OP166W is a 935nm high intensity gallium arsenide infrared emitting diode molded in an IR transmissive amber tinted epoxy package. This package is a T-1 style in all respects except for the length of the plastic package. Lead spacing on this part is .100 inch (2.54mm).

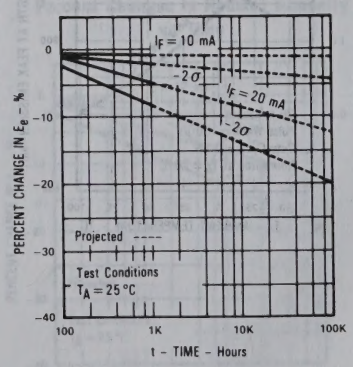
### Absolute Maximum Ratings ($T_A$ 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µsec pulse width, 300 pps) | 3.0A |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 Sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

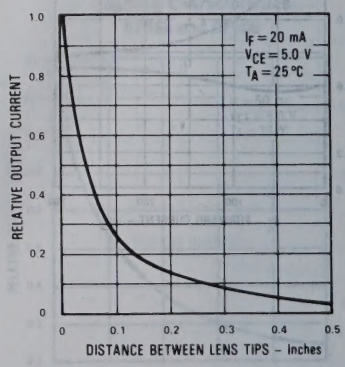
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C.
(3) For identification purposes, cathode lead is 0.060(1.52) nom shorter than anode lead.

### Typical Performance Curves

**Percent Changes in Power Output vs Time**




**Coupling Characteristics of OP166W and OP506W**



# Type OP166W

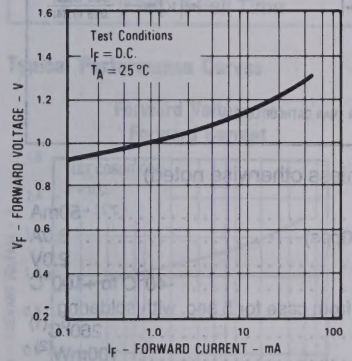
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | 0.50 | | | mW | $I_F$ = 20 mA |
| $V_F$ | Forward Voltage | | | 1.60 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | 100 | μA | $V_R$ = 2.0 V |
| λp | Wavelength at Peak Emission | | 935 | | nm | $I_F$ = 10 mA |
| B | Spectral Bandwidth Between Half Power Points | | 50 | | nm | $I_F$ = 10 mA |
| Δλp/ΔT | Spectral Shift with Temperature | | +0.30 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | 90 | | Deg. | $I_F$ = 20 mA |
| $t_r$ | Output Rise Time | | 1000 | | ns | $I_{F(PK)}$ = 100 mA, |
| $t_f$ | Output Fall Time | | 500 | | ns | PW = 10 μs, D.C. = 10.0% |

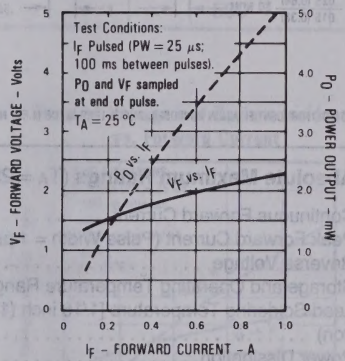


## Typical Performance Curves

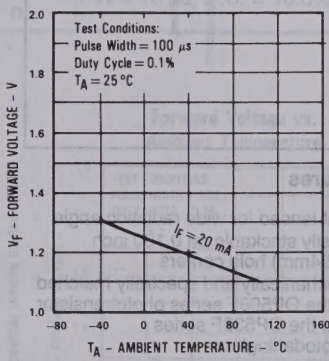
**Forward Voltage vs Forward Current**



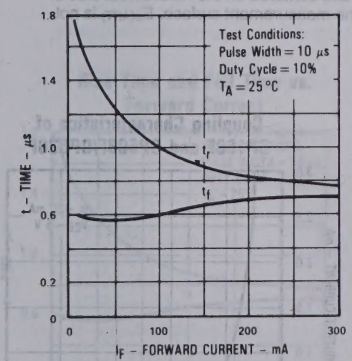

**Forward Voltage and Power Output vs Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 μs;
100 ms between pulses).
$P_O$ and $V_F$ sampled
at end of pulse.
$T_A$ = 25 °C
$P_O$ vs. $I_F$
$V_F$ vs. $I_F$
$V_F$ - FORWARD VOLTAGE - Volts
$P_O$ - POWER OUTPUT - mW
$I_F$ - FORWARD CURRENT - A

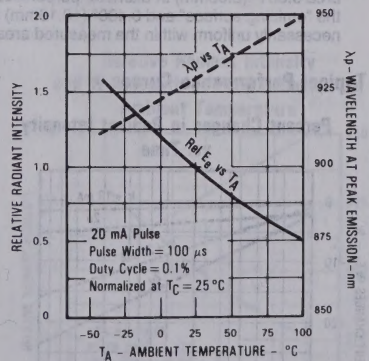
**Forward Voltage vs Ambient Temperature**



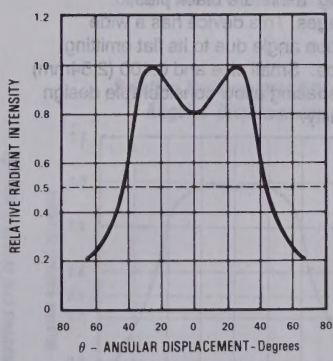

**Rise Time and Fall Time vs Forward Current**




**Normalized Power Output and Wavelength at Peak Emission vs Ambient Temperature**


λp vs $T_A$
Rel $E_e$ vs $T_A$
20 mA Pulse
Pulse Width = 100 μs
Duty Cycle = 0.1%
Normalized at $T_C$ = 25 °C
RELATIVE RADIANT INTENSITY
λp - WAVELENGTH AT PEAK EMISSION - nm
$T_A$ - AMBIENT TEMPERATURE - °C

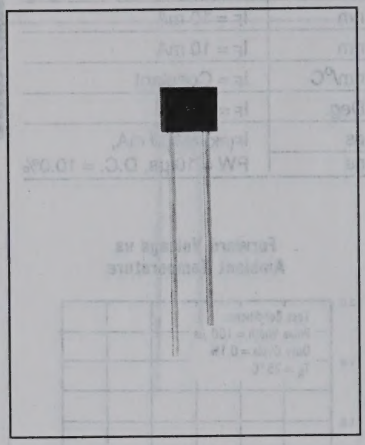
**Relative Radiant Intensity vs Angular Displacement**

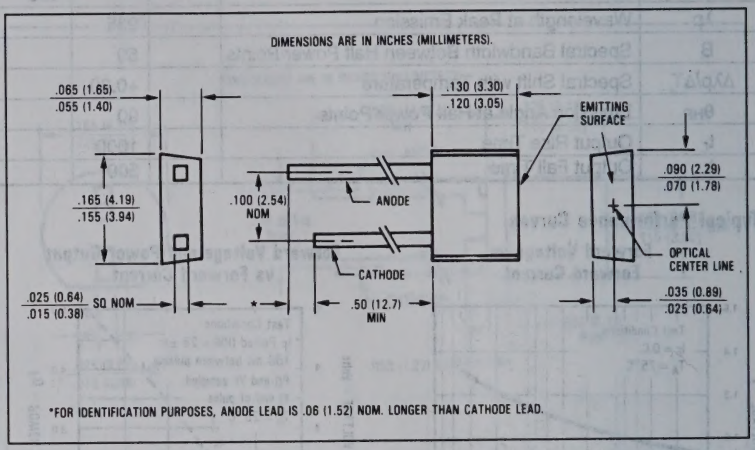



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# GaAs Plastic Infrared Emitting Diodes
## Types OP168FA, OP168FB, OP168FC






### Features

- Flat lensed for wide radiation angle
- Easily stackable on 0.100 inch (2.54mm) hole centers
- Mechanically and spectrally matched to the OP508F series phototransistor and the OP538F series photodarlingtons

### Description

The OP168F series are gallium arsenide infrared emitting diodes molded in "end looking" miniature black plastic packages. This device has a wide radiation angle due to its flat emitting surface. Small size and 0.100 (2.54mm) lead spacing allow considerable design flexibility.

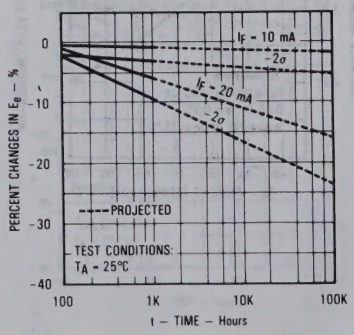
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Continuous Forward Current | 50mA |
| Peak Forward Current (Pulse Width = 1 µsec, 300pps) | 3.0A |
| Reverse Voltage | 2.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

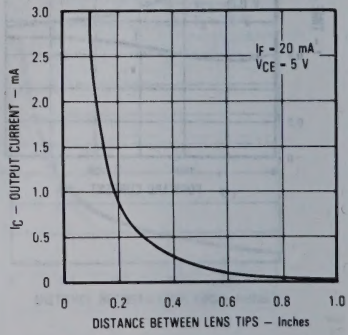
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering. Maximum 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.081" (2.06mm) in diameter perpendicular to and centered on the mechanical axis of the "emitting surface" and 0.400" (10.16mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs. Time**




**Coupling Characteristics of OP168F and OP508F/OP538F**



# Types OP168FA, OP168FB, OP168FC

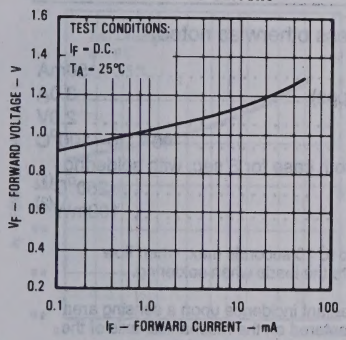
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP168FC<br>OP168FB<br>OP168FA | 0.27<br>0.43<br>0.48 | | 0.73 | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| $V_F$ | Forward Voltage | | | | 1.60 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| λp | Wavelength at Peak Emission | | | 935 | | nm | $I_F$ = 20 mA |
| B | Bandwidth Between Half Power Points | | | 50 | | nm | $I_F$ = 10 mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.30 | | nm/°C | $I_F$ = Constant |
| θHP | Emission Angle at Half Power Points | | | 104 | | Deg. | $I_F$ = 20 mA |
| $t_r$ | Output Rise Time | | | 1000 | | ns | $I_{F(PK)}$ = 100 mA, PW = 10 µs, D.C. = 10.0% |
| $t_f$ | Output Fall Time | | | 500 | | ns | |

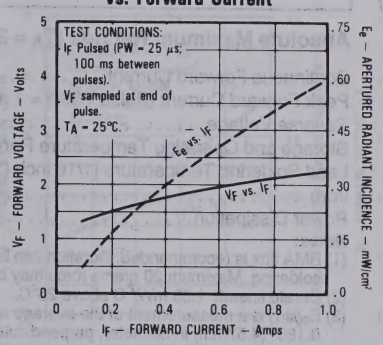


## Typical Performance Curves

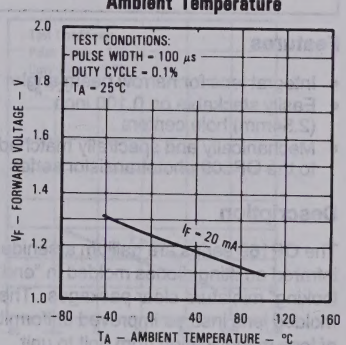
**Forward Voltage vs. Forward Current**



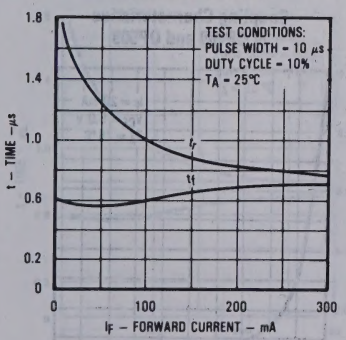

**Forward Voltage and Radiant Incidence vs. Forward Current**


TEST CONDITIONS:
IF Pulsed (PW = 25 µs; 100 ms between pulses).
VF sampled at end of pulse.
TA = 25°C.
Ee vs. IF
VF vs. IF
VF – FORWARD VOLTAGE – Volts
Ee – APERTURED RADIANT INCIDENCE – mW/cm²
IF – FORWARD CURRENT – Amps

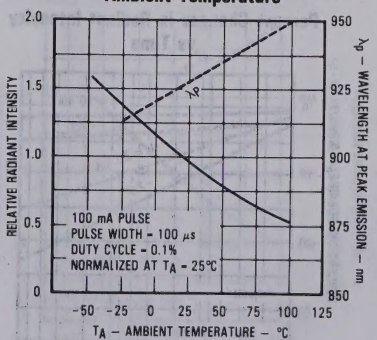
**Forward Voltage vs. Ambient Temperature**



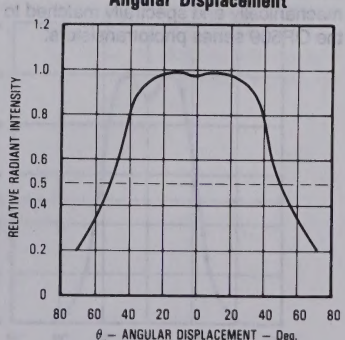

**Rise Time and Fall Time vs. Forward Current**




**Relative Radiant Intensity and Wavelength at Peak Emission vs. Ambient Temperature**


100 mA PULSE
PULSE WIDTH = 100 µs
DUTY CYCLE = 0.1%
NORMALIZED AT TA = 25°C
λp
RELATIVE RADIANT INTENSITY
λp – WAVELENGTH AT PEAK EMISSION – nm
TA – AMBIENT TEMPERATURE – °C

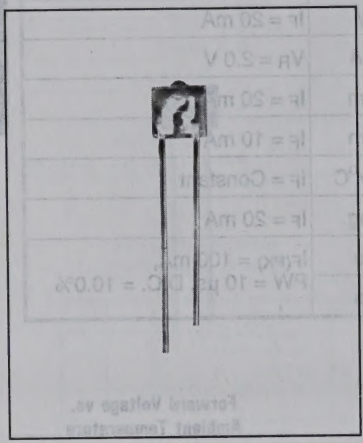
**Relative Radiant Intensity vs. Angular Displacement**

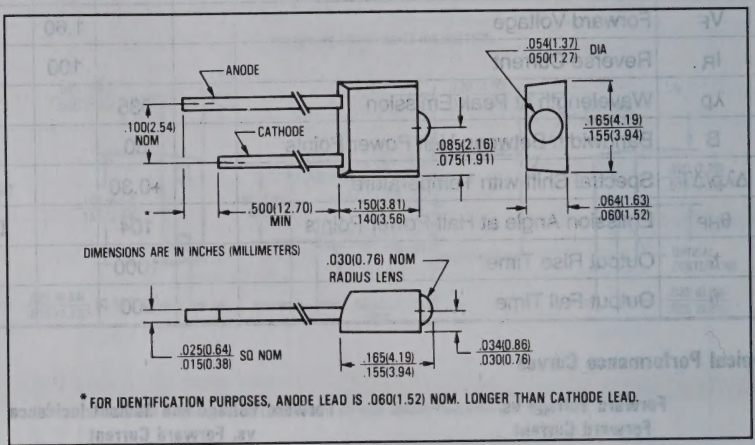



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# GaAs Plastic Infrared Emitting Diodes
## Types OP169A, OP169B, OP169C






### Features

- Integral lens for narrow beam angle
- Easily stackable on 0.100 inch (2.54mm) hole centers
- Mechanically and spectrally matched to the OP509 phototransistor series

### Description

The OP169 series are gallium arsenide infrared emitting diodes molded in "end looking" miniature clear packages. The molded lens insures improved uniformity of lens magnification from unit to unit. The OP169 series provides a broad range of on-line and radiant intensities and has considerable design flexibility due to its small size. These devices are mechanically and spectrally matched to the OP509 series phototransistors.

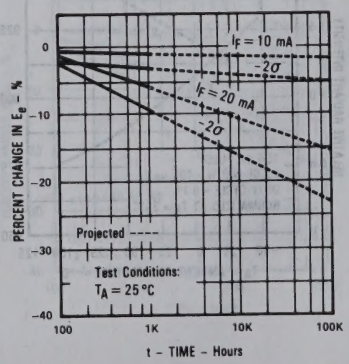
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Continuous Forward Current | 50mA |
| Peak Forward Current (Pulse Width = 1 µsec, 300pps) | 3.0A |
| Reverse Voltage | 2.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

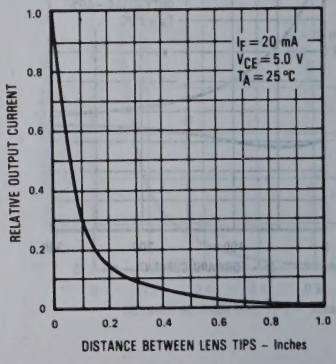
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering. Maximum 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.180" (4.57mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.653" (16.6mm) from the lens tip. $E_{e(APT)}$ is a measurement of the average radiant intensity within the cone formed by the above conditions. $E_{e(APT)}$ is not necessarily uniform within the measured area.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics of OP169 and OP509**



# Types OP169A, OP169B, OP169C

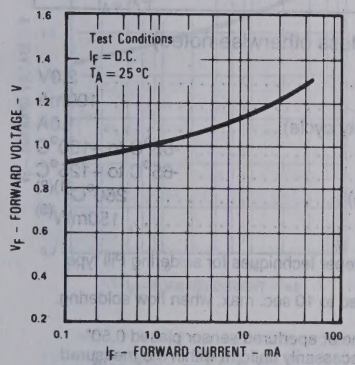
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP169C<br>OP169B<br>OP169A | 0.027<br>0.108<br>0.180 | | 0.220 | mW/cm$^2$ | $I_F$ = 20mA(3) |
| $V_F$ | Forward Voltage | | | | 1.60 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0V |
| λp | Wavelength at Peak Emission | | | 935 | | nm | $I_F$ = 20mA |
| B | Bandwidth Between Half Power Points | | | 50 | | nm | $I_F$ = 10mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.30 | | nm/°C | $I_F$ = Constant |
| θHP | Emission Angle at Half Power Points | | | 46 | | Deg. | $I_F$ = 20mA |
| $t_r$ | Output Rise Time | | | 1000 | | ns | $I_{F(PK)}$ = 100mA, PW = 10 µs, D.C. = 10.0% |
| $t_f$ | Output Fall Time | | | 500 | | ns | |

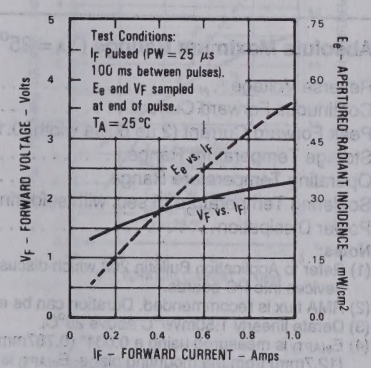
INFRARED EMITTING DIODES

## Typical Performance Curves

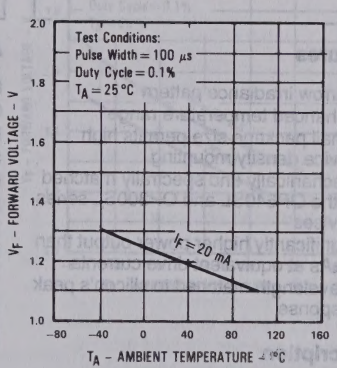
**Forward Voltage vs Forward Current**



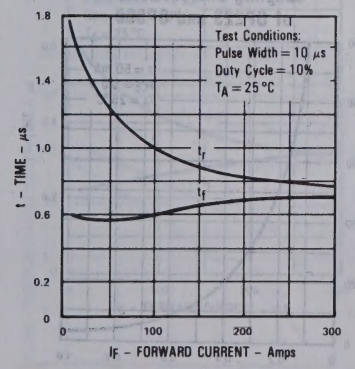

**Forward Voltage and Radiant Incidence vs Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs
100 ms between pulses).
$E_e$ and $V_F$ sampled
at end of pulse.
$T_A$ = 25 °C
$E_e$ vs. $I_F$
$V_F$ vs. $I_F$
$V_F$ - FORWARD VOLTAGE - Volts
$E_e$ - APERTURED RADIANT INCIDENCE - mW/cm$^2$
$I_F$ - FORWARD CURRENT - Amps

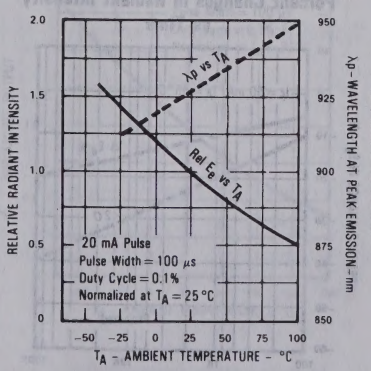
**Forward Voltage vs Ambient Temperature**



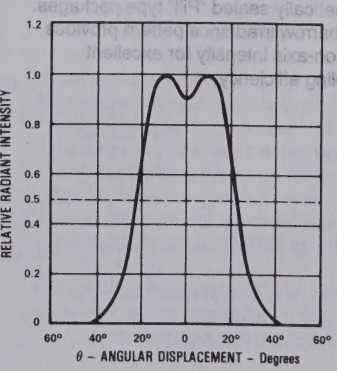

**Rise Time and Fall Time vs Forward Current**




**Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature**


λp vs $T_A$
Rel $E_e$ vs $T_A$
20 mA Pulse
Pulse Width = 100 µs
Duty Cycle = 0.1%
Normalized at $T_A$ = 25 °C
RELATIVE RADIANT INTENSITY
λp - WAVELENGTH AT PEAK EMISSION - nm
$T_A$ - AMBIENT TEMPERATURE - °C

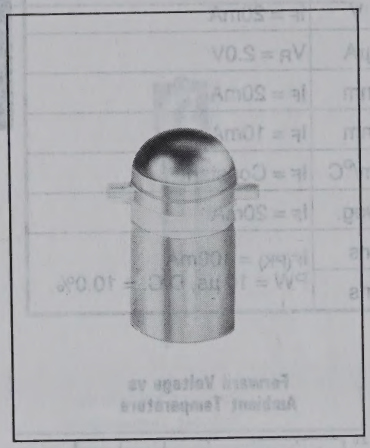
**Relative Radiant Intensity vs Angular Displacement**

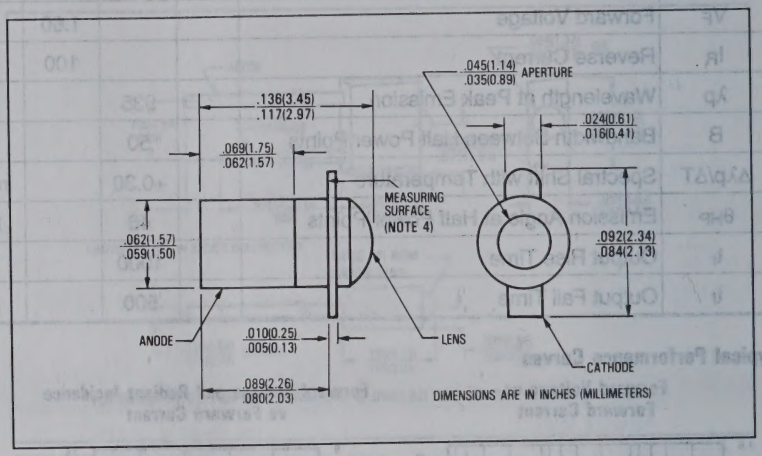



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# GaAlAs Hermetic Infrared Emitting Diodes
## Types OP223, OP224



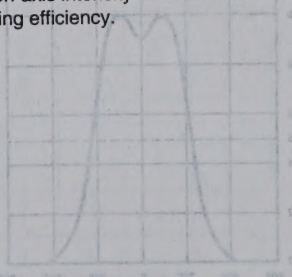



### Features

- Narrow irradiance pattern
- Enhanced temperature range
- Small package size permits high device density mounting
- Mechanically and spectrally matched to the OP640SL and OP300SL series devices
- Significantly higher power output than GaAs at equivalent drive currents
- Wavelength matched to silicon's peak response

### Description

The OP223 and OP224 devices are 890nm gallium aluminum arsenide infrared emitting diodes mounted in hermetically sealed "Pill" type packages. The narrow irradiance pattern provides high on-axis intensity for excellent coupling efficiency.



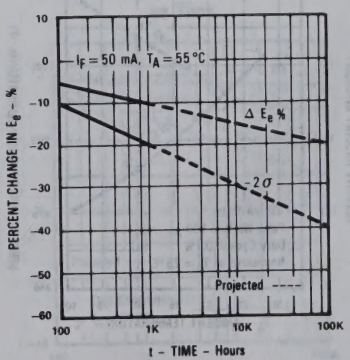
### Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 100mA |
| Peak Forward Current (2 µs pulse width, 0.1% duty cycle) | 1.0A |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Soldering Temperature (5 sec. with soldering iron) | 260°C(1)(2) |
| Power Dissipation | 150mW(3) |

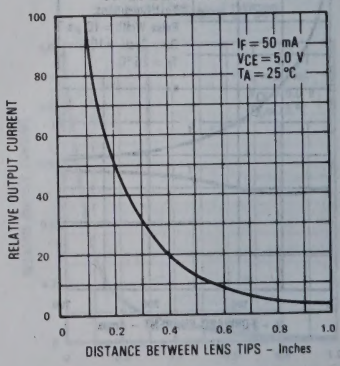
**Notes:**
(1) Refer to Application Bulletin 202 which discusses proper techniques for soldering Pill type devices into PC boards.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 1.50mW/°C above 25°C.
(4) $E_{e(APT)}$ is measured using a 0.031" (0.787mm) diameter apertured sensor placed 0.50" (12.7mm) from the mounting plane. $E_{e(APT)}$ is not necessarily uniform within the measured area.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics of OP223 and OP600**



# Types OP223, OP224

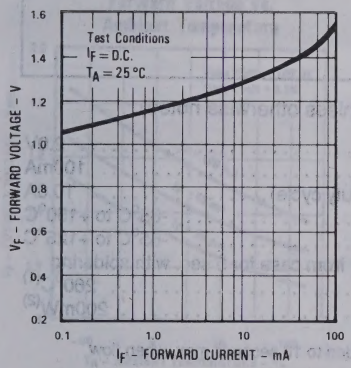
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP223<br>OP224 | 1.00<br>3.50 | | | $mW/cm^2$<br>$mW/cm^2$ | $I_F$ = 50mA(4)<br>$I_F$ = 50mA(4) |
| $V_F$ | Forward Voltage | | | | 1.80 | V | $I_F$ = 50mA |
| $I_R$ | Reverse Current | | | | 100 | μA | $V_R$ = 2.0V |
| λp | Wavelength at Peak Emission | | | 890 | | nm | $I_F$ = 10mA |
| B | Spectral Bandwidth Between Half Power Points | | | 80 | | nm | $I_F$ = 10mA |
| Δ λp/ΔT | Spectral Shift with Temperature | | | +0.18 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 24 | | Deg. | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 500 | | ns | $I_{F(PK)}$ = 100mA, PW = 10μs |
| $t_f$ | Output Fall Time | | | 250 | | ns | D.C. = 10.0% |

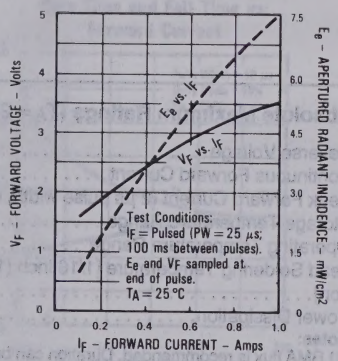
INFRARED EMITTING DIODES

## Typical Performance Curves

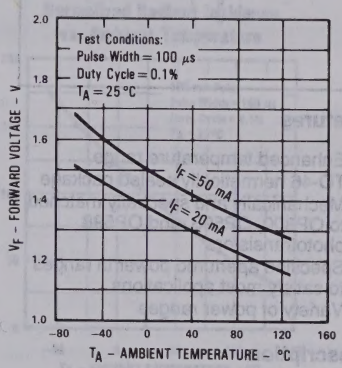
**Forward Voltage vs Forward Current**



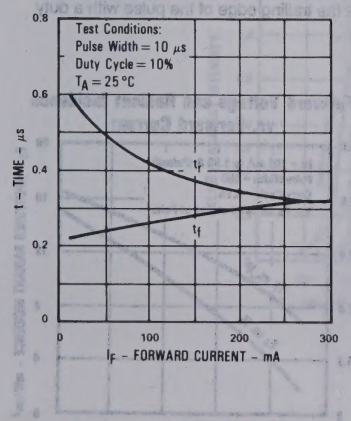

**Forward Voltage and Radiant Incidence vs Forward Current**


$E_e$ vs $I_F$
$V_F$ vs $I_F$
Test Conditions:
$I_F$ = Pulsed (PW = 25 μs; 100 ms between pulses).
$E_e$ and $V_F$ sampled at end of pulse.
$T_A$ = 25 °C
$V_F$ - FORWARD VOLTAGE - Volts
$E_e$ - APERTURED RADIANT INCIDENCE - mW/cm2
$I_F$ - FORWARD CURRENT - Amps

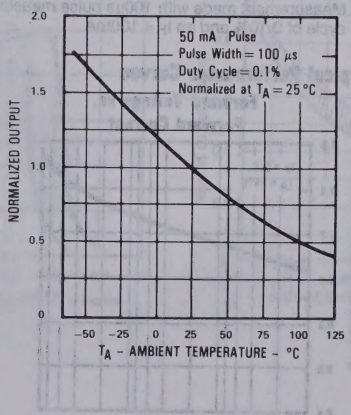
**Forward Voltage vs Ambient Temperature**




**Rise Time and Fall Time vs Forward Current**



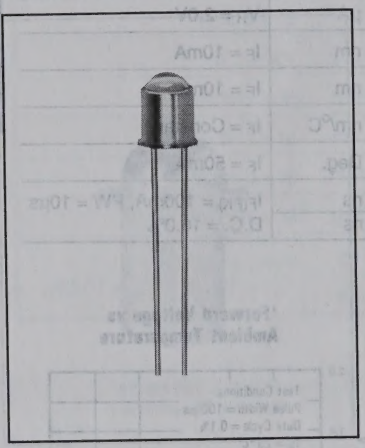

**Normalized Power Output vs Ambient Temperature**

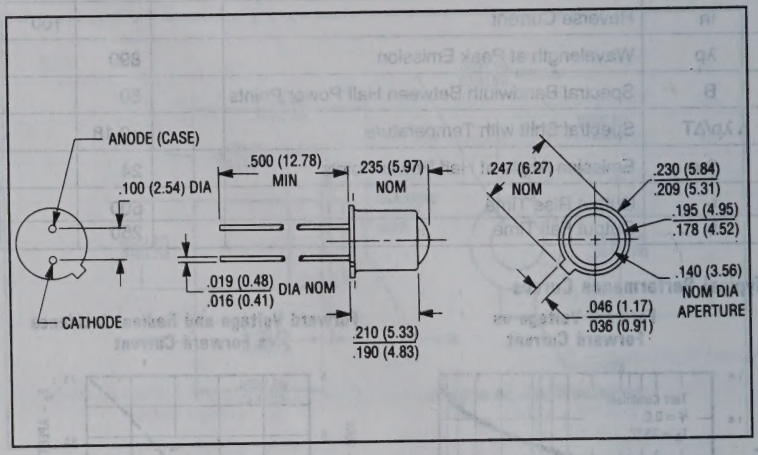



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# GaAlAs Hermetic Infrared Emitting Diodes
## Types OP231, OP232, OP233






### Features

- Enhanced temperature range
- TO-46 hermetically sealed package
- Mechanically and spectrally matched to OP800, OP593, and OP598 phototransistors
- Specified apertured power in ranges to satisfy most applications
- Variety of power ranges

### Description

The OP231 series devices are gallium aluminum arsenide infrared emitting diodes mounted in hermetic TO-46 housings. Gallium aluminum arsenide features higher radiated output than gallium arsenide at the same forward current. The wavelength is centered at 890 nm which closely matches the spectral response of silicon phototransistors. The OP231 series is lensed to provide a narrow beam angle (18° between half power points). The narrow beam angle and the specified radiant intensity of the OP231 series allow ease of design in beam interrupt applications in conjunction with the OP800 or OP598 series photosensor.

Please refer to application bulletins 208 and 210 for additional design information and reliability (degradation) data.

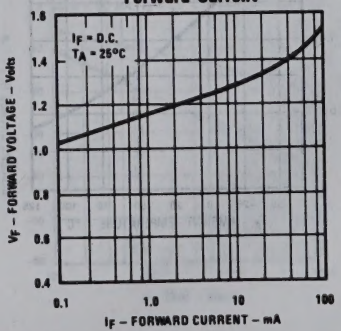
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 100mA |
| Peak Forward Current (2 µs pulse width, 0.1% duty cycle) | 10.0A |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 200mW(2) |

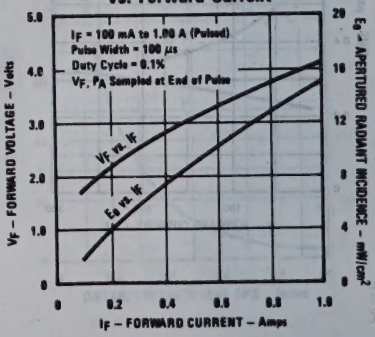
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering.
(2) Derate linearly 2.0 mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average radiant intensity within the cone formed by the measurement surface, a radius of 1.429" (36.30mm) measured from the lens side of the tab to the sensing surface and a sensing surface of 0.250" (6.35mm) in diameter forming a 10° cone. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(4) Measurement made with 100µs pulse measured at the trailing edge of the pulse with a duty cycle of 0.10% and an $I_F$ = 100mA.

### Typical Performance Curves

**Forward Voltage vs. Forward Current**




**Forward Voltage and Radiant Incidence vs. Forward Current**



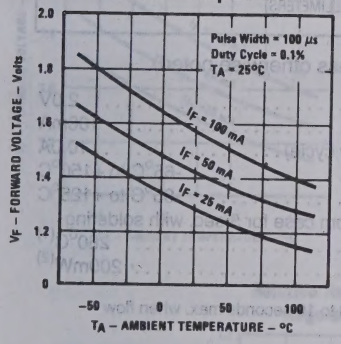
# Types OP231, OP232, OP233

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

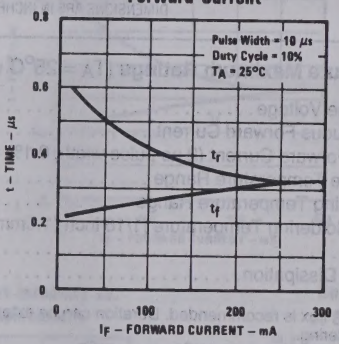
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP231 | 1.5 | | | mW/cm$^2$ | $I_F$ = 100 mA(3)(4) |
| | | OP232 | 2.0 | | 6.0 | mW/cm$^2$ | $I_F$ = 100 mA(3)(4) |
| | | OP233 | 3.0 | | | mW/cm$^2$ | $I_F$ = 100 mA(3)(4) |
| $P_O$ | Radiant Power Output | OP231 | | 6.0 | | mW | $I_F$ = 100 mA(3)(4) |
| | | OP232 | | 8.0 | | mW | $I_F$ = 100 mA(3)(4) |
| | | OP233 | | 10.0 | | mW | $I_F$ = 100 mA(3)(4) |
| $V_F$ | Forward Voltage | | | | 2.0 | V | $I_F$ = 100 mA(4) |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| $\lambda p$ | Wavelength at Peak Emission | | | 890 | | nm | $I_F$ = 10 mA |
| B | Spectral Bandwidth Half Power Points | | | 80 | | nm | $I_F$ = 10 mA |
| $\Delta\lambda_P/\Delta T$ | Spectral Shift with Temperature | | | +0.30 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 18 | | Deg. | $I_F$ = 100 mA |
| $t_r$ | Output Rise Time | | | 500 | | ns | $I_{F(PK)}$ = 100 mA, |
| $t_f$ | Output Fall Time | | | 250 | | ns | PW = 10µs, D.C. = 10% |

## Typical Performance Curves

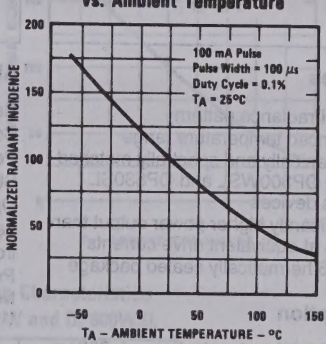
**Forward Voltage vs. Ambient Temperature**



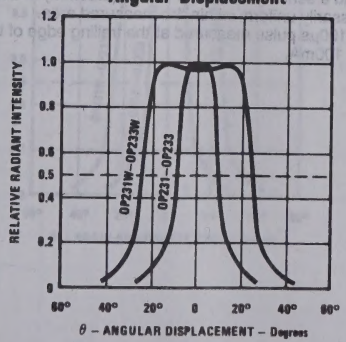

**Rise Time and Fall Time vs. Forward Current**



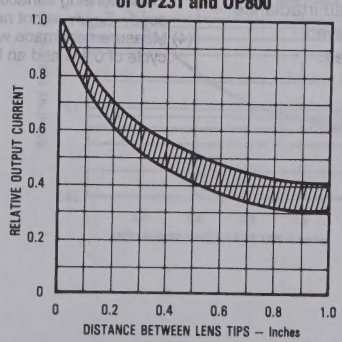

**Normalized Radiant Incidence vs. Ambient Temperature**




**Relative Radiant Intensity vs. Angular Displacement**




**Coupling Characteristics of OP231 and OP800**

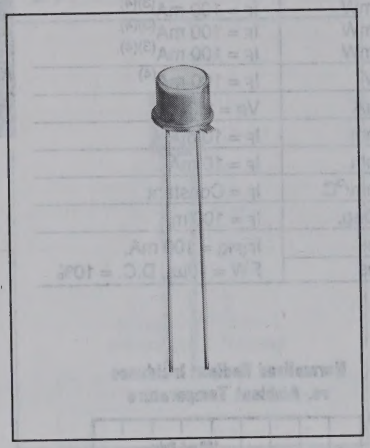


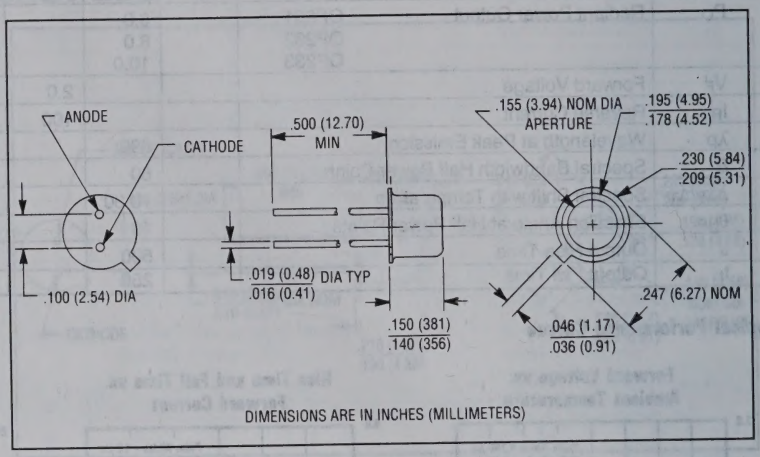



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# GaAlAs Hermetic Infrared Emitting Diodes
## Types OP231W, OP232W






### Features

- Wide irradiance pattern
- Enhanced temperature range
- Mechanically and spectrally matched to the OP800WSL and OP830SL series devices
- Significantly higher power output than GaAs at equivalent drive currents
- TO-46 hermetically sealed package

### Description

The OP231W series devices are 890nm gallium aluminum arsenide infrared emitting diodes mounted in hermetically sealed packages. The broad irradiance pattern provides relatively even illumination over a large area.

### Replaces

K6300 series

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 100mA |
| Peak Forward Current (2 µs pulse width, 0.1% duty cycle) | 10.0A |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 200mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering.
(2) Derate linearly 2.0 mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average radiant intensity within the cone formed by the measurement surface, a radius of 0.466" (11.84mm) measured from the lens side of the tab to the sensing surface, and a sensing surface of 0.250" (6.35mm) in diameter forming a 30° cone. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(4) Measurement made with 100µs pulse measured at the trailing edge of the pulse with a duty cycle of 0.1% and an $I_F$ = 100mA.

# Types OP231W, OP232W

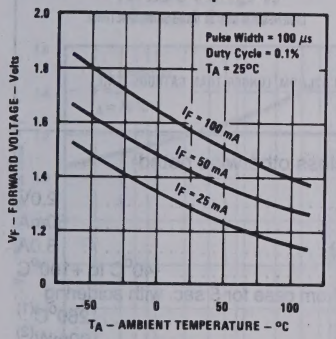
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence OP231W | 1.5 | | | mW/cm$^2$ | $I_F$ = 100 mA[3][4] |
| | OP232W | 3.5 | | 7.0 | mW/cm$^2$ | $I_F$ = 100 mA[3][4] |
| $V_F$ | Forward Voltage | | | 2.0 | V | $I_F$ = 100 mA[4] |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0 V |
| λp | Wavelength at Peak Emission | | 890 | | nm | $I_F$ = 10 mA |
| B | Spectral Bandwidth Half Power Points | | 80 | | nm | $I_F$ = 10 mA |
| $\Delta\lambda_P/\Delta T$ | Spectral Shift with Temperature | | +0.30 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | 50 | | Deg. | $I_F$ = 100 mA |
| $t_r$ | Output Rise Time | | 500 | | ns | $I_{F(PK)}$ = 100 mA, |
| $t_f$ | Output Fall Time | | 250 | | ns | PW = 10 µs, D.C. = 10% |

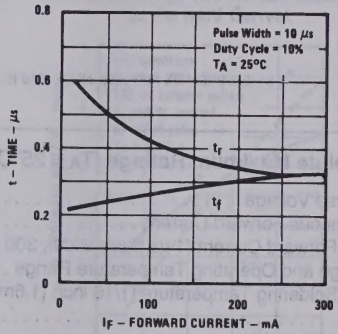


## Typical Performance Curves

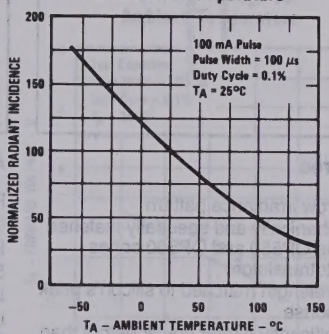
**Forward Voltage vs. Ambient Temperature**



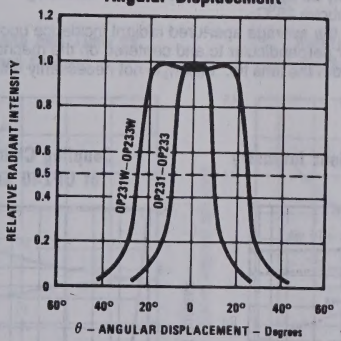

**Rise Time and Fall Time vs. Forward Current**



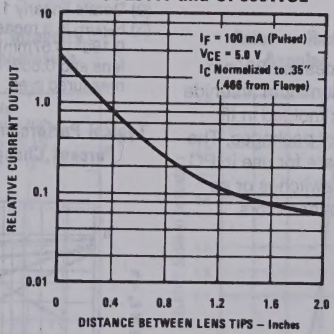

**Normalized Radiant Incidence vs. Ambient Temperature**




**Relative Radiant Intensity vs. Angular Displacement**

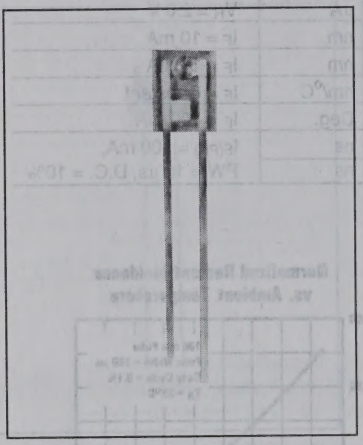


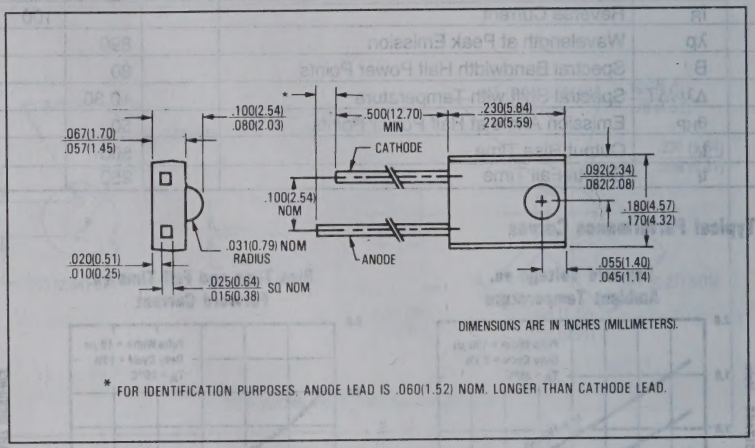

**Coupling Characteristics of OP231W and OP800WSL**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# GaAlAs Plastic Infrared Emitting Diodes
## Types OP240A, OP240B, OP240C, OP240D






### Features

- Narrow irradiance pattern
- Mechanically and spectrally matched to the OP550 and OP560 series phototransistors
- Wavelength matched to silicon's peak response
- Significantly higher power output than GaAs at equivalent drive currents
- Side-looking package for space limited applications

### Description

The OP240 series devices are 890nm high intensity gallium aluminum arsenide infrared emitting diodes molded in IR transmissive clear epoxy packages. The side-looking packages are for use in PC board mounted slotted switches or as easily mounted interrupt detectors.

### Replaces

OP240SL series

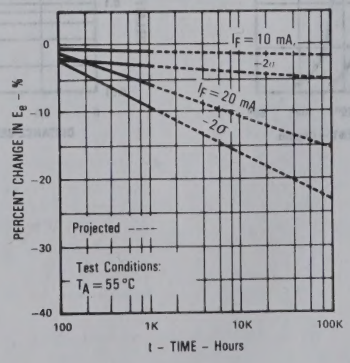
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

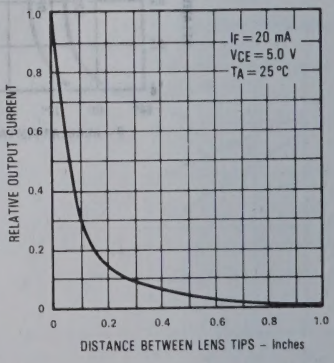
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.180" (4.57mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 0.653" (16.6mm) from the lens tip. $E_{e(APT)}$ is not necessarily uniform within the measured area.

**Typical Performance Curves**

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics of OP240 and OP550**



# Types OP240A, OP240B, OP240C, OP240D

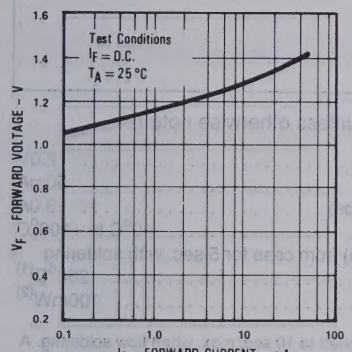
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP240D | 0.05 | | | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP240C | 0.20 | | 0.86 | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP240B | 0.40 | | 1.20 | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP240A | 0.60 | | | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| $V_F$ | Forward Voltage | | | | 1.80 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| λp | Wavelength at Peak Emission | | | 890 | | nm | $I_F$ = 10 mA |
| B | Spectral Bandwidth Between Half Power Points | | | 80 | | nm | $I_F$ = 10 mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.18 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 40 | | Deg. | $I_F$ = 20 mA |
| $t_r$ | Output Rise Time | | | 500 | | ns | $I_{F(PK)}$ = 100 mA, |
| $t_f$ | Output Fall Time | | | 250 | | ns | PW = 10 µs, D.C. = 10% |

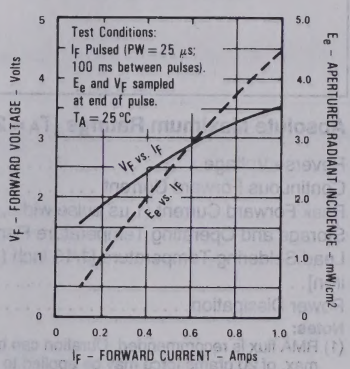


## Typical Performance Curves

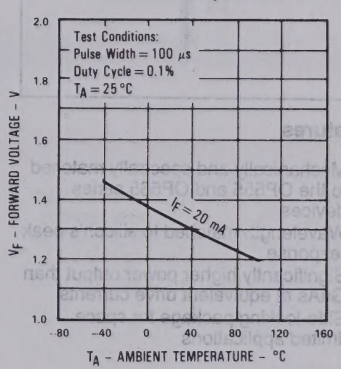
**Forward Voltage vs Forward Current**



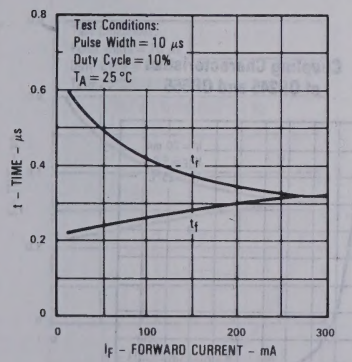

**Forward Voltage and Radiant Incidence vs Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs;
100 ms between pulses).
$E_e$ and $V_F$ sampled
at end of pulse.
$T_A$ = 25 °C
$V_F$ vs. $I_F$
$E_e$ vs. $I_F$
$V_F$ – FORWARD VOLTAGE – Volts
$E_e$ – APERTURED RADIANT INCIDENCE – mW/cm$^2$
$I_F$ – FORWARD CURRENT – Amps

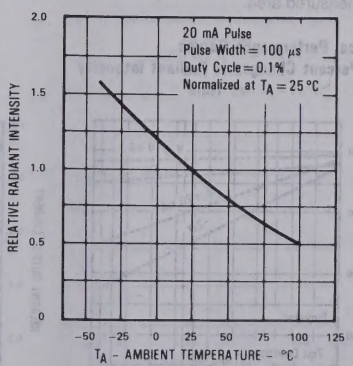
**Forward Voltage vs Ambient Temperature**



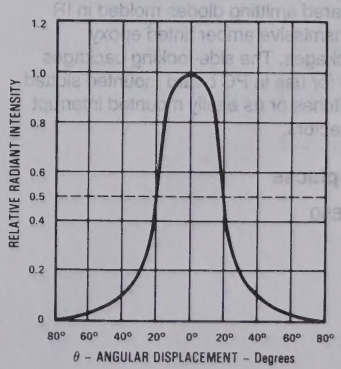

**Rise Time and Fall Time vs Forward Current**




**Relative Radiant Intensity vs Ambient Temperature**

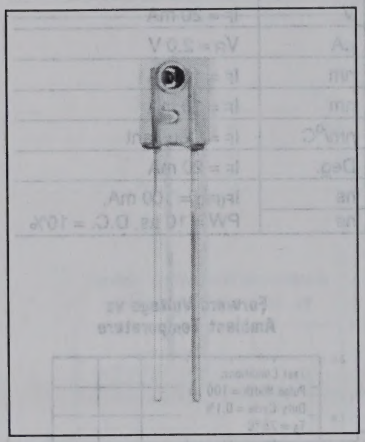


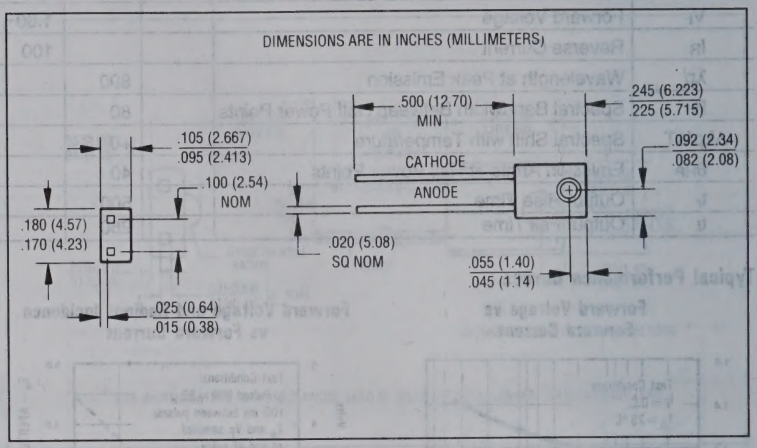

**Relative Radiant Intensity vs Angular Displacement**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# GaAlAs Plastic Infrared Emitting Diodes
## Types OP245A, OP245B, OP245C, OP245D






### Features

- Mechanically and spectrally matched to the OP555 and OP565 series devices
- Wavelength matched to silicon's peak response
- Significantly higher power output than GaAs at equivalent drive currents
- Side-looking package for space limited applications

### Description

The OP245 series devices are 890nm high intensity gallium aluminum arsenide infrared emitting diodes molded in IR transmissive amber tinted epoxy packages. The side-looking packages are for use in PC board mounted slotted switches or as easily mounted interrupt detectors.

### Replaces

K6650

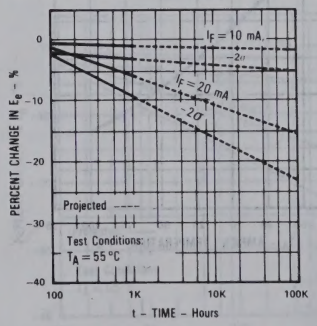
### Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

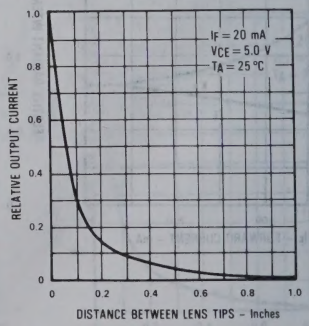
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.180" (4.57mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.653" (16.6mm) from the lens tip. $E_{e(APT)}$ is not necessarily uniform within the measured area.

**Typical Performance Curves**

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics of OP245 and OP555**



# Types OP245A, OP245B, OP245C, OP245D

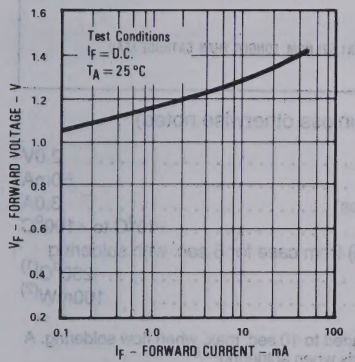
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP245D | 0.05 | | | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP245C | 0.20 | | 0.86 | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP245B | 0.40 | | 1.20 | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP245A | 0.60 | | | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| $V_F$ | Forward Voltage | | | | 1.80 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| λp | Wavelength at Peak Emission | | | 890 | | nm | $I_F$ = 10 mA |
| B | Spectral Bandwidth Between Half Power Points | | | 80 | | nm | $I_F$ = 10 mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.18 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 40 | | Deg. | $I_F$ = 20 mA |
| $t_r$ | Output Rise Time | | | 500 | | ns | $I_{F(PK)}$ = 100 mA, |
| $t_f$ | Output Fall Time | | | 250 | | ns | PW = 10 µs, D.C. = 10.0% |

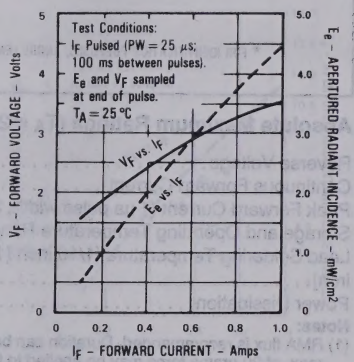


## Typical Performance Curves

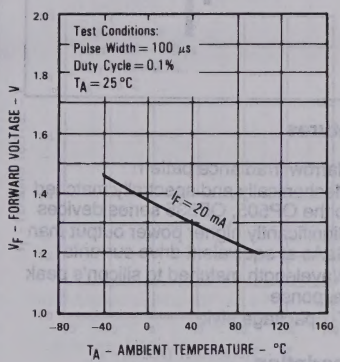
**Forward Voltage vs Forward Current**



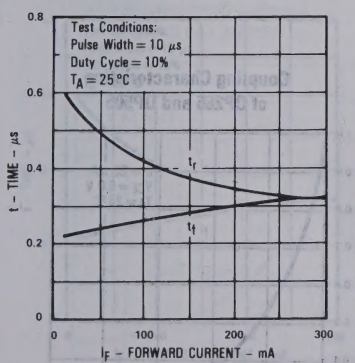

**Forward Voltage and Radiant Incidence vs Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs;
100 ms between pulses).
$E_e$ and $V_F$ sampled
at end of pulse.
$T_A$ = 25 °C
$V_F$ vs. $I_F$
$E_e$ vs. $I_F$
$V_F$ - FORWARD VOLTAGE - Volts
$E_e$ - APERTURED RADIANT INCIDENCE - mW/cm$^2$
$I_F$ - FORWARD CURRENT - Amps

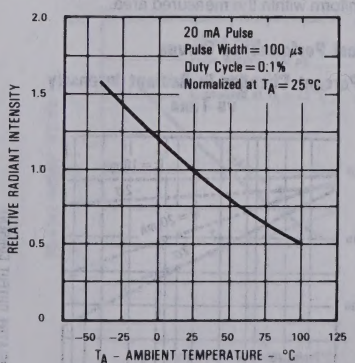
**Forward Voltage vs Ambient Temperature**



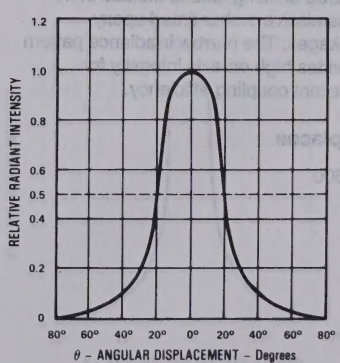

**Rise Time and Fall Time vs Forward Current**




**Relative Radiant Intensity vs Ambient Temperature**

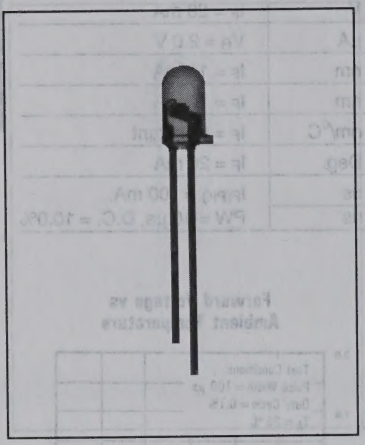


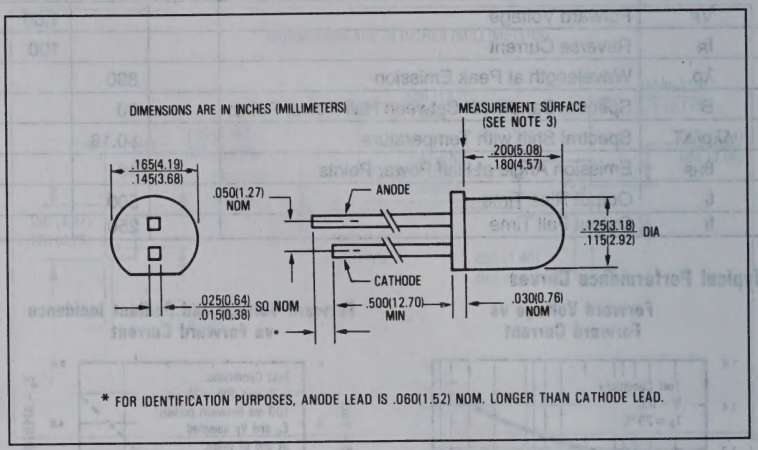

**Relative Radiant Intensity vs Angular Displacement**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# GaAlAs Plastic Infrared Emitting Diodes
## Types OP265A, OP265B, OP265C, OP265D






### Features

- Narrow irradiance pattern
- Mechanically and spectrally matched to the OP505, OP535 series devices
- Significantly higher power output than GaAs at equivalent drive currents
- Wavelength matched to silicon's peak response
- T-1 package style

### Description

The OP265 series devices are 890nm high intensity gallium aluminum arsenide infrared emitting diodes molded in IR transmissive amber tinted epoxy packages. The narrow irradiance pattern provides high on-axis intensity for excellent coupling efficiency.

### Replaces

K6600

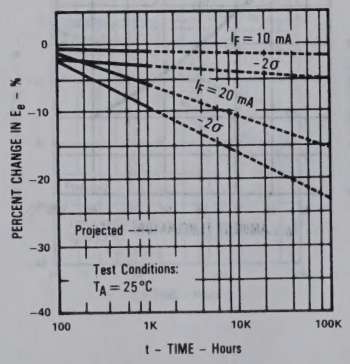
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

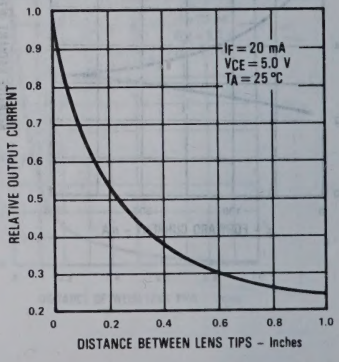
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.081" (2.06mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.590" (14.99mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics of OP265 and OP505**



# Types OP265A, OP265B, OP265C, OP265D

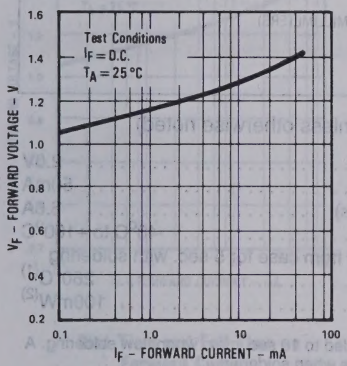
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP265D | 0.54 | | | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP265C | 0.54 | | 3.30 | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP265B | 1.65 | | 4.70 | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP265A | 2.70 | | | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| $V_F$ | Forward Voltage | | | | 1.80 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| λp | Wavelength at Peak Emission | | | 890 | | nm | $I_F$ = 10 mA |
| B | Spectral Bandwidth Between Half Power Points | | | 80 | | nm | $I_F$ = 10 mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.18 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 18 | | Deg. | $I_F$ = 20mA |
| $t_r$ | Output Rise Time | | | 500 | | ns | $I_{F(PK)}$ = 100 mA, |
| $t_f$ | Output Fall Time | | | 250 | | ns | PW = 10µs, D.C. = 10.0% |

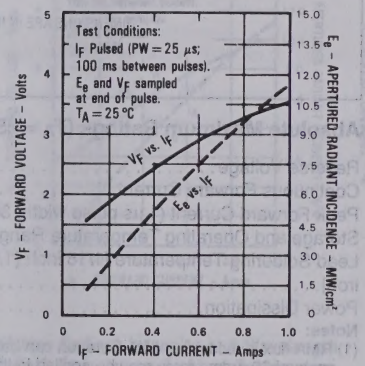


## Typical Performance Curves

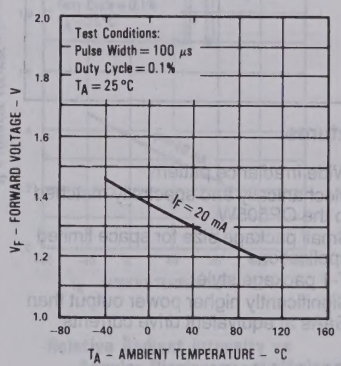
**Forward Voltage vs Forward Current**



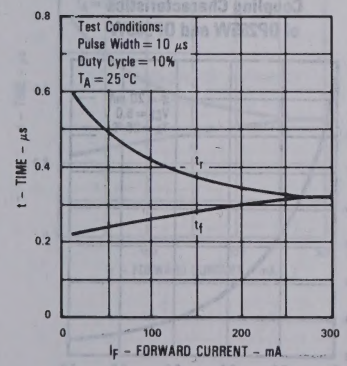

**Forward Voltage and Radiant Incidence vs Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs; 100 ms between pulses).
$E_e$ and $V_F$ sampled at end of pulse.
$T_A$ = 25 °C
$V_F$ vs. $I_F$
$E_e$ vs. $I_F$
$V_F$ – FORWARD VOLTAGE – Volts
$E_e$ – APERTURED RADIANT INCIDENCE – mW/cm$^2$
$I_F$ – FORWARD CURRENT – Amps

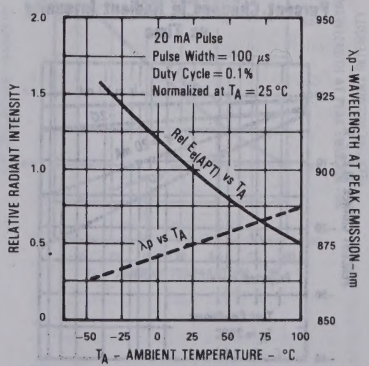
**Forward Voltage vs Ambient Temperature**



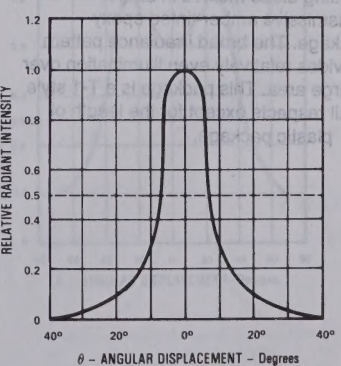

**Rise Time and Fall Time vs Forward Current**




**Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature**


20 mA Pulse
Pulse Width = 100 µs
Duty Cycle = 0.1%
Normalized at $T_A$ = 25 °C
Rel $E_{e(APT)}$ vs $T_A$
λp vs $T_A$
RELATIVE RADIANT INTENSITY
λp – WAVELENGTH AT PEAK EMISSION – nm
$T_A$ – AMBIENT TEMPERATURE – °C

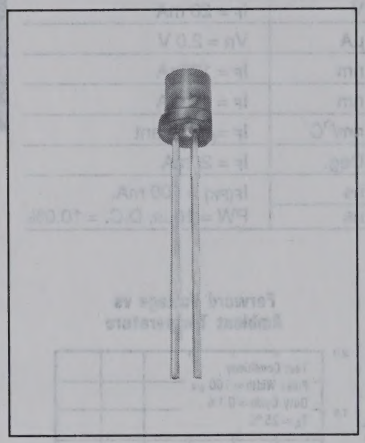
**Relative Radiant Intensity vs Angular Displacement**

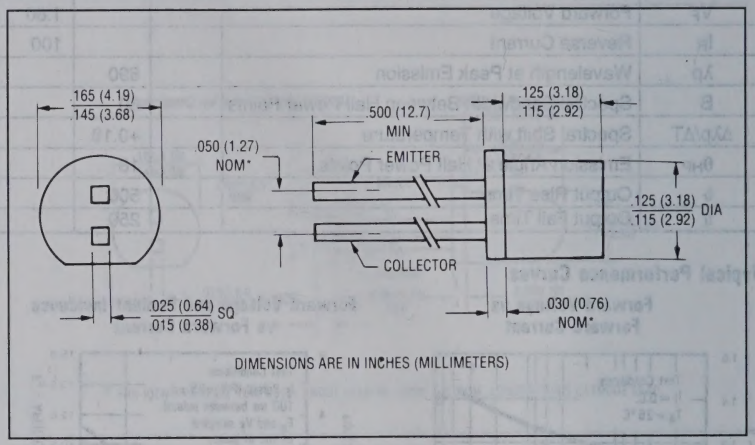



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# GaAlAs Plastic Infrared Emitting Diode
## Type OP265W






### Features

- Wide irradiance pattern
- Mechanically and spectrally matched to the OP505W
- Small package size for space limited applications
- T-1 package style
- Significantly higher power output than GaAs at equivalent drive currents

### Description

The OP265W is an 890nm high intensity gallium aluminum arsenide infrared emitting diode molded in an IR transmissive amber-tinted epoxy package. The broad irradiance pattern provides relatively even illumination over a large area. This package is a T-1 style in all respects except for the length of the plastic package.

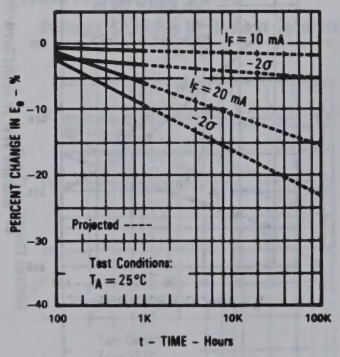
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

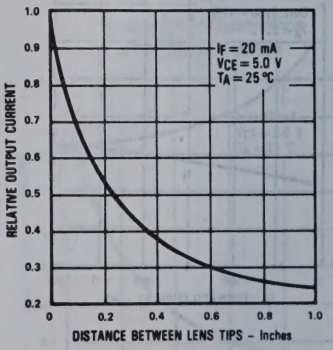
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics of OP265W and OP505W**



# Type OP265W

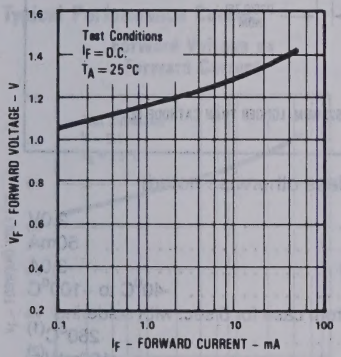
**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | 1.00 | | | mW | $I_F = 20$ mA |
| $V_F$ | Forward Voltage | | | 1.80 | V | $I_F = 20$ mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R = 2.0$ V |
| $\lambda p$ | Wavelength at Peak Emission | | 890 | | nm | $I_F = 10$ mA |
| B | Spectral Bandwidth Between Half Power Points | | 80 | | nm | $I_F = 10$ mA |
| $\Delta\lambda p/\Delta T$ | Spectral Shift with Temperature | | +0.18 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | 90 | | Deg. | $I_F$ = 20 mA |
| $t_r$ | Output Rise Time | | 500 | | ns | $I_{F(PK)} = 100$ mA, |
| $t_f$ | Output Fall Time | | 250 | | ns | PW = 10µs, D.C. = 10.0% |

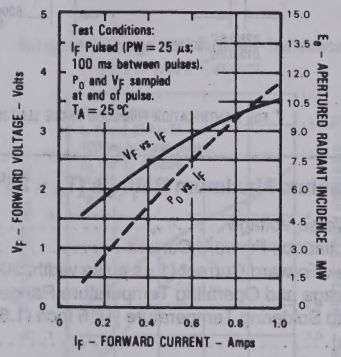


## Typical Performance Curves

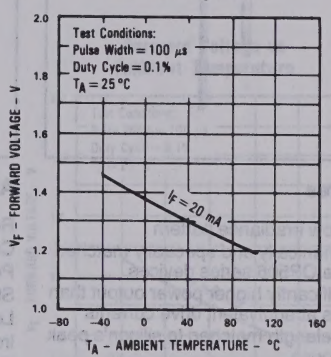
**Forward Voltage vs Forward Current**



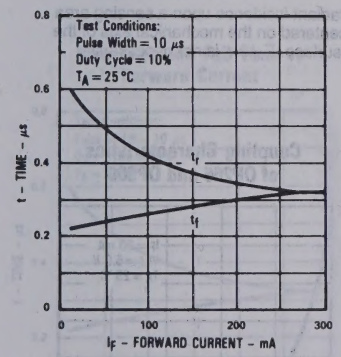

**Forward Voltage and Radiant Incidence vs Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs; 100 ms between pulses).
$P_O$ and $V_F$ sampled at end of pulse.
$T_A$ = 25 °C
$V_F$ vs. $I_F$
$P_O$ vs. $I_F$
$V_F$ - FORWARD VOLTAGE - Volts
$E_e$ - APERTURED RADIANT INCIDENCE - MW
$I_F$ - FORWARD CURRENT - Amps

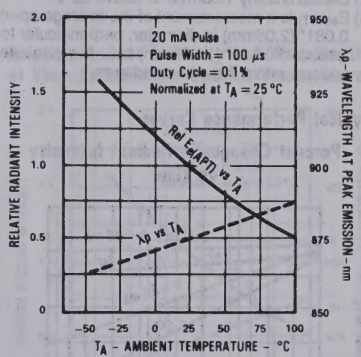
**Forward Voltage vs Ambient Temperature**



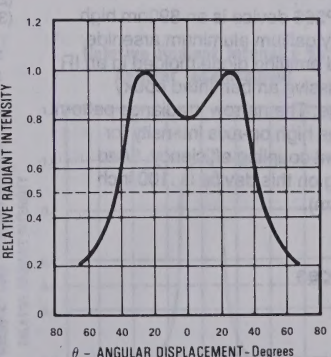

**Rise Time and Fall Time vs Forward Current**




**Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature**

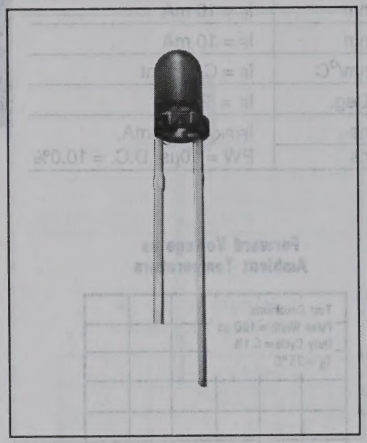

20 mA Pulse
Pulse Width = 100 µs
Duty Cycle = 0.1%
Normalized at $T_A$ = 25 °C
Rel $E_e(APT)$ vs $T_A$
$\lambda p$ vs $T_A$
RELATIVE RADIANT INTENSITY
$\lambda_P$ - WAVELENGTH AT PEAK EMISSION - nm
$T_A$ - AMBIENT TEMPERATURE - °C

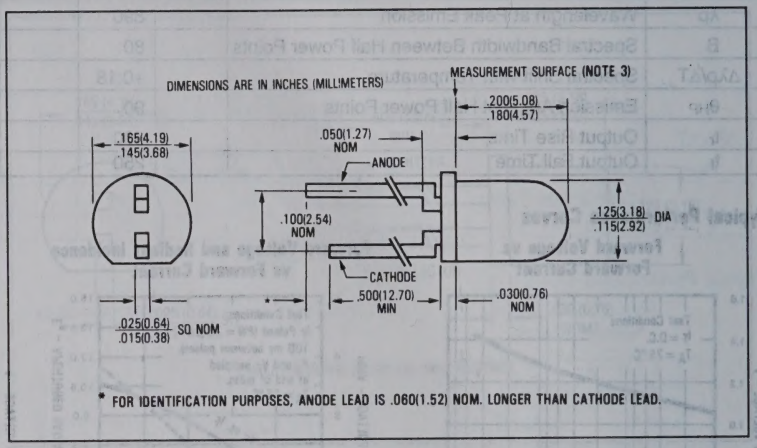
**Relative Radiant Intensity vs Angular Displacement**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# GaAlAs Plastic Infrared Emitting Diodes
## Types OP266A, OP266B, OP266C, OP266D






### Features

- Narrow irradiance pattern
- Mechanically and spectrally matched to the OP506 series devices
- Significantly higher power output than GaAs at equivalent drive currents
- Wavelength matched to silicon's peak response
- T-1 package style

### Description

The OP266 device is an 890nm high intensity gallium aluminum arsenide infrared emitting diode molded in an IR transmissive amber tinted epoxy package. The narrow irradiance pattern provides high on-axis intensity for excellent coupling efficiency. Lead spacing on this device is .100 inch (2.54mm).

### Replaces

OP261

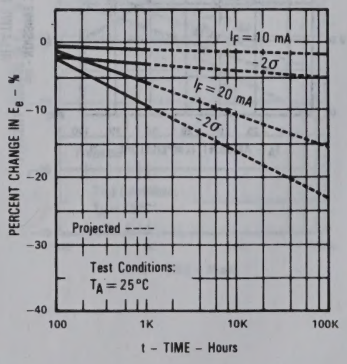
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

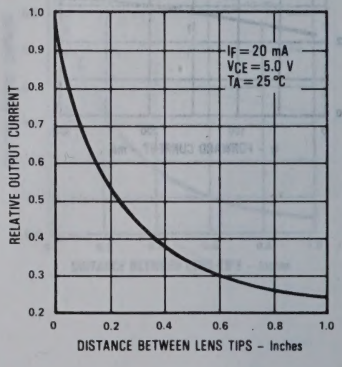
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.081" (2.06mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.590" (14.99mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics of OP266 and OP506**



# Types OP266A, OP266B, OP266C, OP266D

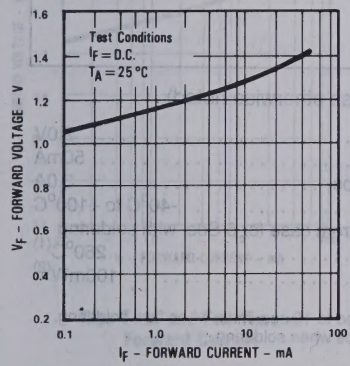
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP266D | 0.54 | | | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP266C | 0.54 | | 3.30 | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP266B | 1.65 | | 4.70 | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| | | OP266A | 2.70 | | | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| $V_F$ | Forward Voltage | | | | 1.80 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| λp | Wavelength at Peak Emission | | | 890 | | nm | $I_F$ = 10 mA |
| B | Spectral Bandwidth Between Half Power Points | | | 80 | | nm | $I_F$ = 10 mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.18 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 18 | | Deg. | $I_F$ = 20 mA |
| $t_r$ | Output Rise Time | | | 500 | | ns | $I_{F(PK)}$ = 100 mA, |
| $t_f$ | Output Fall Time | | | 250 | | ns | PW = 10 µs, D.C. = 10.0% |

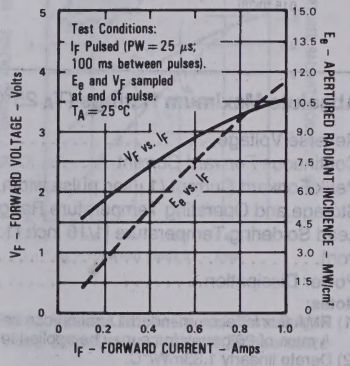


## Typical Performance Curves

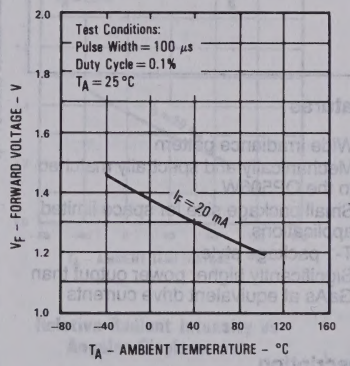
**Forward Voltage vs Forward Current**



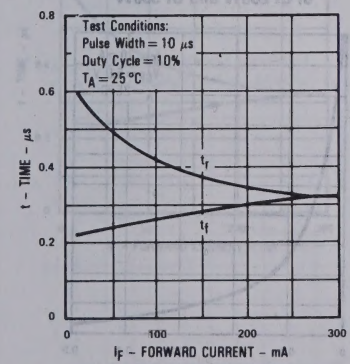

**Forward Voltage and Radiant Incidence vs Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs;
100 ms between pulses).
$E_e$ and $V_F$ sampled
at end of pulse.
$T_A$ = 25 °C
$V_F$ vs. $I_F$
$E_e$ vs. $I_F$
$V_F$ – FORWARD VOLTAGE – Volts
$E_e$ – APERTURED RADIANT INCIDENCE – mW/cm$^2$
$I_F$ – FORWARD CURRENT – Amps

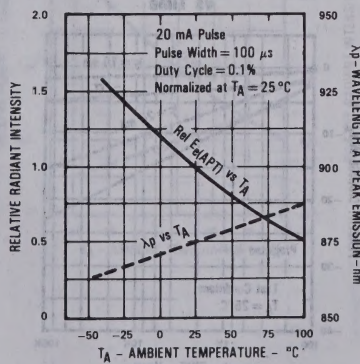
**Forward Voltage vs Ambient Temperature**



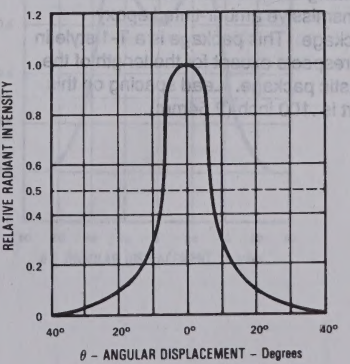

**Rise Time and Fall Time vs Forward Current**




**Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature**

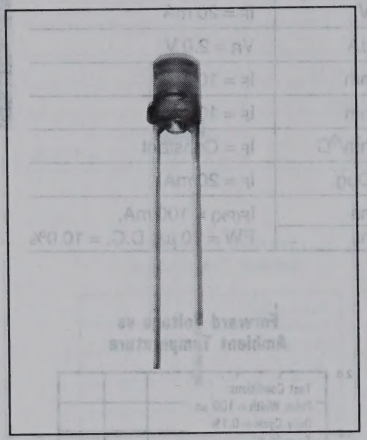

20 mA Pulse
Pulse Width = 100 µs
Duty Cycle = 0.1%
Normalized at $T_A$ = 25 °C
Rel $E_{e(APT)}$ vs $T_A$
λp vs $T_A$
RELATIVE RADIANT INTENSITY
λp – WAVELENGTH AT PEAK EMISSION – nm
$T_A$ – AMBIENT TEMPERATURE – °C

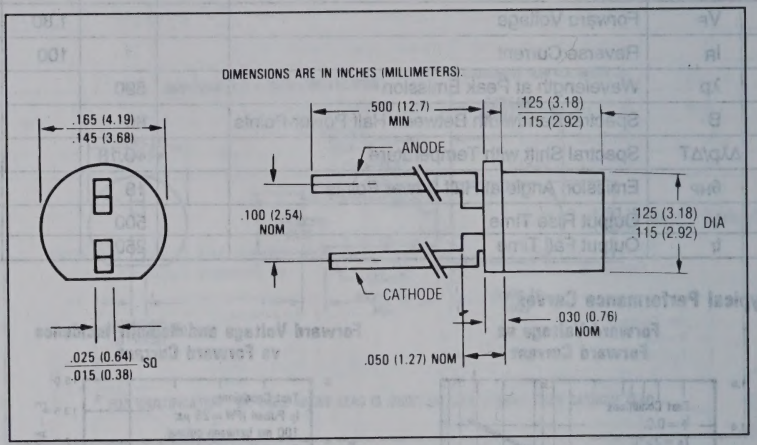
**Relative Radiant Intensity vs Angular Displacement**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# GaAlAs Plastic Infrared Emitting Diode
## Type OP266W






### Features

- Wide irradiance pattern
- Mechanically and spectrally matched to the OP506W
- Small package size for space limited applications
- T-1 package style
- Significantly higher power output than GaAs at equivalent drive currents

### Description

The OP266W is an 890nm high intensity gallium aluminum arsenide infrared emitting diode molded in an IR transmissive amber-tinted epoxy package. This package is a T-1 style in all respects except for the length of the plastic package. Lead spacing on this part is .100 inch (2.54mm).

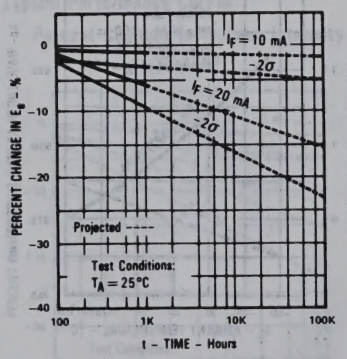
### Absolute Maximum Ratings ($T_A$ 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µsec pulse width, 300 pps) | 3.0A |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 Sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

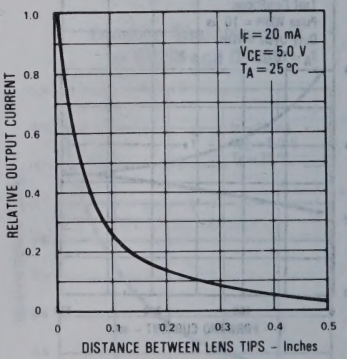
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics of OP266W and OP506W**



# Type OP266W

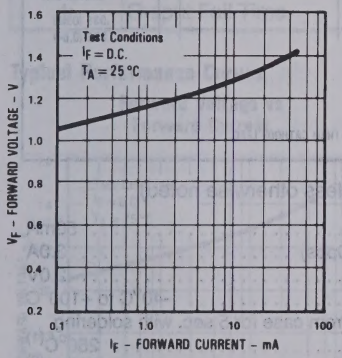
**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | 1.00 | | | mW | $I_F = 20$ mA |
| $V_F$ | Forward Voltage | | | 1.80 | V | $I_F = 20$ mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R = 2.0$ V |
| $\lambda p$ | Wavelength at Peak Emission | | 890 | | nm | $I_F = 10$ mA |
| B | Spectral Bandwidth Between Half Power Points | | 80 | | nm | $I_F = 10$ mA |
| $\Delta\lambda p/\Delta T$ | Spectral Shift with Temperature | | +0.18 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | 90 | | Deg. | $I_F = 20$ mA |
| $t_r$ | Output Rise Time | | 500 | | ns | $I_{F(PK)} = 100$ mA, |
| $t_f$ | Output Fall Time | | 250 | | ns | PW = 10 µs, D.C. = 10.0% |

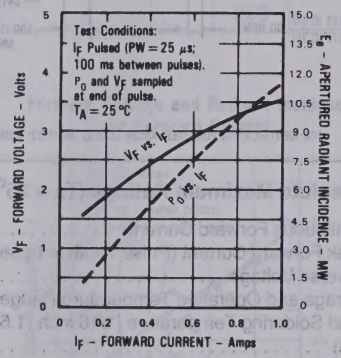


## Typical Performance Curves

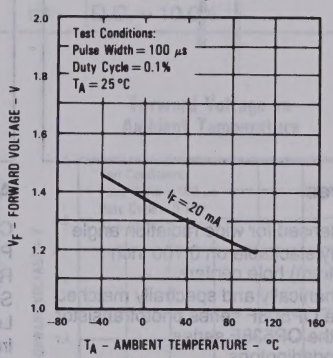
**Forward Voltage vs Forward Current**



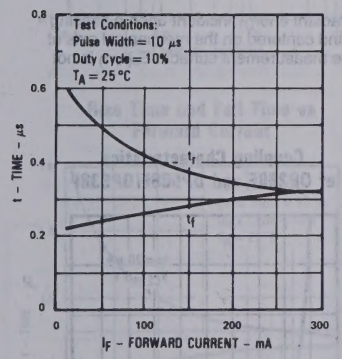

**Forward Voltage and Radiant Incidence vs Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs;
100 ms between pulses).
$P_O$ and $V_F$ sampled
at end of pulse.
$T_A$ = 25 °C
$V_F$ vs. $I_F$
$P_O$ vs. $I_F$
$V_F$ - FORWARD VOLTAGE - Volts
$E_e$ - APERTURED RADIANT INCIDENCE - mW
$I_F$ - FORWARD CURRENT - Amps

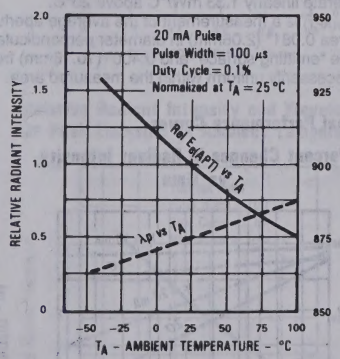
**Forward Voltage vs Ambient Temperature**



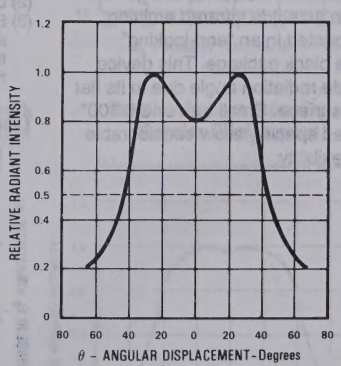

**Rise Time and Fall Time vs Forward Current**




**Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature**

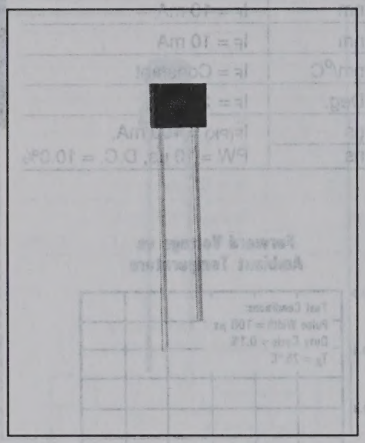

20 mA Pulse
Pulse Width = 100 µs
Duty Cycle = 0.1%
Normalized at $T_A$ = 25 °C
Rel $E_e(APT)$ vs $T_A$
$\lambda p$ vs $T_A$
RELATIVE RADIANT INTENSITY
$T_A$ - AMBIENT TEMPERATURE - °C

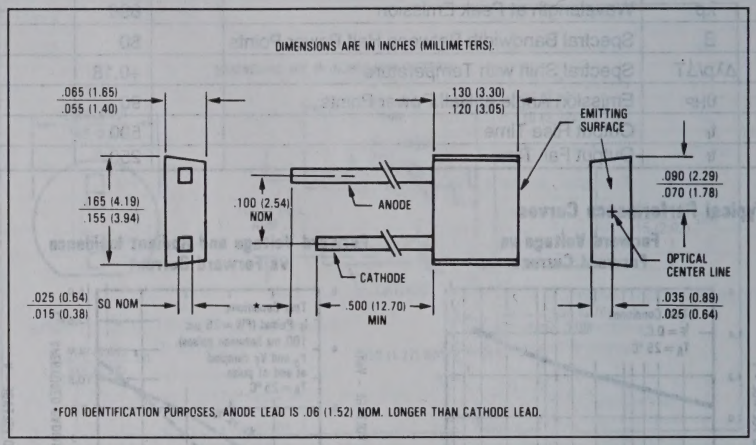
**Relative Radiant Intensity vs Angular Displacement**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# GaAlAs Plastic Infrared Emitting Diodes
## Types OP268FA, OP268FB, OP268FC






### Features

- Flat lensed for wide radiation angle
- Easily stackable on 0.100 inch (2.54mm) hole centers
- Mechanically and spectrally matched to the OP508F series phototransistor and the OP538F series photodarlingtons

### Description

The OP268F series contains a gallium aluminum arsenide infrared emitting diode mounted in an "end-looking" miniature black package. This device has a wide radiation angle due to its flat emitting surface. Small size and 0.100" (2.54) lead spacing allow considerable design flexibility.

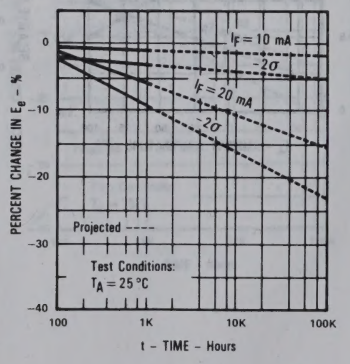
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Continuous Forward Current | 50mA |
| Peak Forward Current (Pulse Width = 1 µsec, 300pps) | 3.0A |
| Reverse Voltage | 2.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

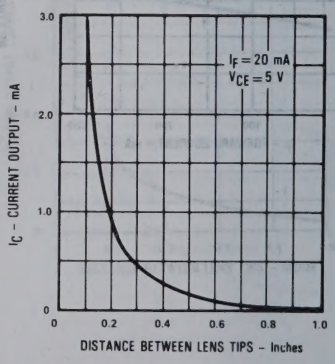
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering. Maximum 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.081" (2.06mm) in diameter perpendicular to and centered on the mechanical axis of the "emitting surface" and 0.400" (10.16mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs Time**




**Coupling Characteristics of OP268F and OP508F/OP538F**



# Types OP268FA, OP268FB, OP268FC

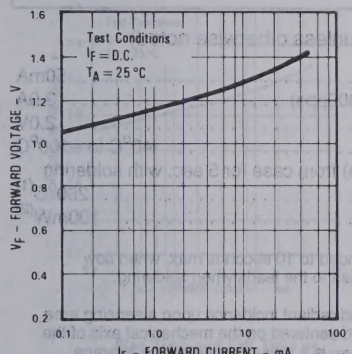
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP268FC<br>OP268FB<br>OP268FA | 0.36<br>0.45<br>0.64 | | 0.99 | mW/cm$^2$ | $I_F$ = 20mA(3) |
| $V_F$ | Forward Voltage | | | | 1.80 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0V |
| λp | Wavelength at Peak Emission | | | 890 | | nm | $I_F$ = 20mA |
| B | Bandwidth Between Half Power Points | | | 80 | | nm | $I_F$ = 10mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.18 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 104 | | Deg. | $I_F$ = 20mA |
| $t_r$ | Output Rise Time | | | 500 | | ns | $I_{F(PK)}$ = 100mA, PW = 10.0µs, |
| $t_f$ | Output Fall Time | | | 250 | | ns | D.C. = 10.0% |

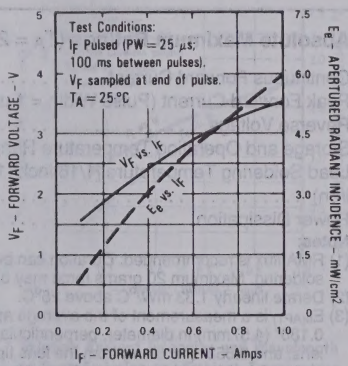


## Typical Performance Curves

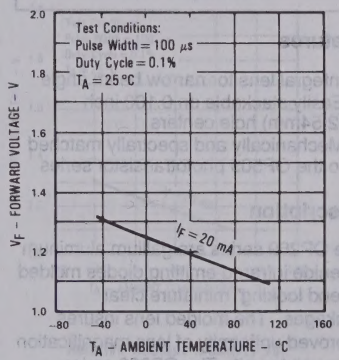
**Forward Voltage vs Forward Current**



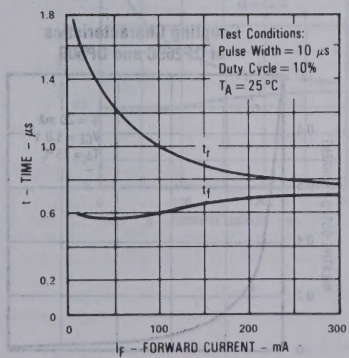

**Forward Voltage and Radiant Incidence vs Forward Current**


Test Conditions:
$I_F$ Pulsed (PW = 25 µs;
100 ms between pulses).
$V_F$ sampled at end of pulse.
$T_A$ = 25 °C
$V_F$ vs. $I_F$
$E_e$ vs. $I_F$
$V_F$ - FORWARD VOLTAGE - V
$E_e$ - APERTURED RADIANT INCIDENCE - mW/cm$^2$
$I_F$ - FORWARD CURRENT - Amps

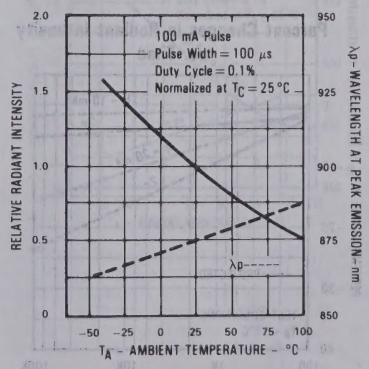
**Forward Voltage vs Ambient Temperature**



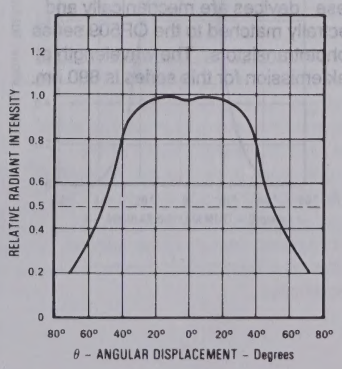

**Rise Time and Fall Time vs Forward Current**




**Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature**


100 mA Pulse
Pulse Width = 100 µs
Duty Cycle = 0.1%
Normalized at $T_C$ = 25 °C
λp
RELATIVE RADIANT INTENSITY
λp - WAVELENGTH AT PEAK EMISSION - nm
$T_A$ - AMBIENT TEMPERATURE - °C

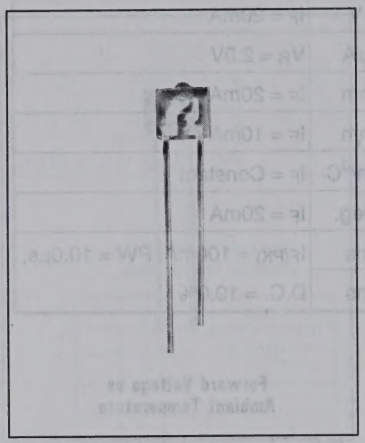
**Relative Radiant Intensity vs Angular Displacement**

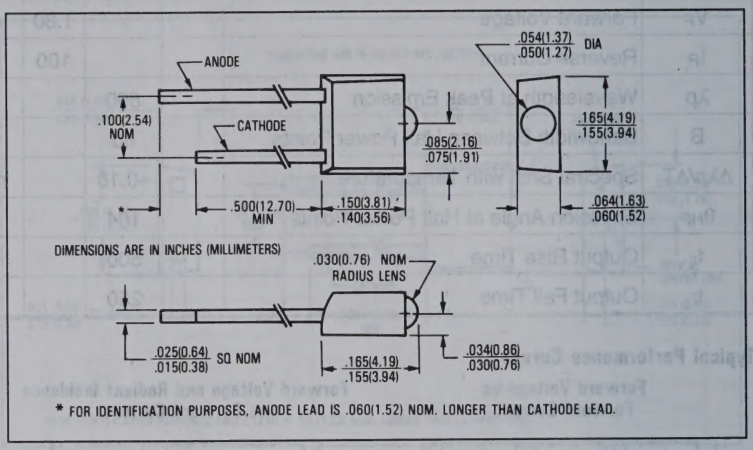



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# GaAlAs Plastic Infrared Emitting Diodes
## Types OP269A, OP269B, OP269C






### Features

- Integral lens for narrow beam angle
- Easily stackable on 0.100 inch (2.54mm) hole centers
- Mechanically and spectrally matched to the OP509 phototransistor series

### Description

The OP269 series are gallium aluminum arsenide infrared emitting diodes molded in "end looking" miniature clear packages. The molded lens insures improved uniformity of lens magnification from unit to unit. The OP269 series provides a broad range of on-line and radiant intensities and has considerable design flexibility due to its small size. These devices are mechanically and spectrally matched to the OP509 series of phototransistors. The wavelength at peak emission for this series is 890 nm.

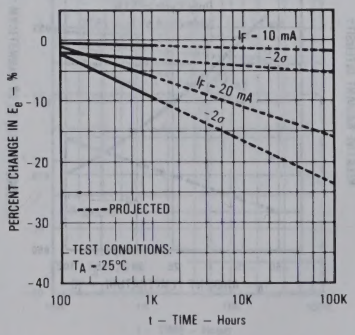
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Continuous Forward Current | 50mA |
| Peak Forward Current (Pulse Width = 1 µsec, 300pps) | 3.0A |
| Reverse Voltage | 2.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

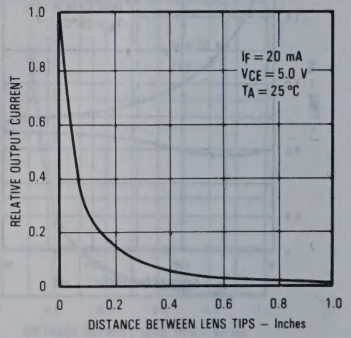
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering. Maximum 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.180" (4.57mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.653" (16.6mm) from the lens tip. $E_{e(APT)}$ is a measurement of the average radiant intensity within the cone formed by the above conditions. $E_{e(APT)}$ is not necessarily uniform within the measured area.

### Typical Performance Curves

**Percent Changes in Radiant Intensity vs. Time**




**Coupling Characteristics of OP269C and OP509**




Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OP269A, OP269B, OP269C

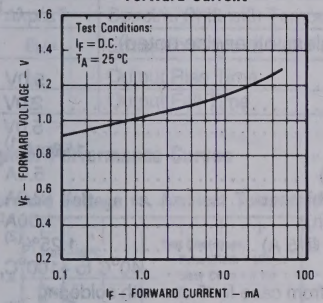
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP269C<br>OP269B<br>OP269A | 0.34<br>0.42<br>0.58 | | 0.82 | mW/cm$^2$ | $I_F$ = 20 mA(3) |
| $V_F$ | Forward Voltage | | | | 1.80 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| λp | Wavelength at Peak Emission | | | 890 | | nm | $I_F$ = 20 mA |
| B | Bandwidth Between Half Power Points | | | 80 | | nm | $I_F$ = 10 mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.18 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 46 | | Deg. | $I_F$ = 20 mA |
| $t_r$ | Output Rise Time | | | 500 | | ns | $I_{F(PK)}$ = 100 mA, PW = 10 µs, |
| $t_f$ | Output Fall Time | | | 250 | | ns | D.C. = 10.0% |

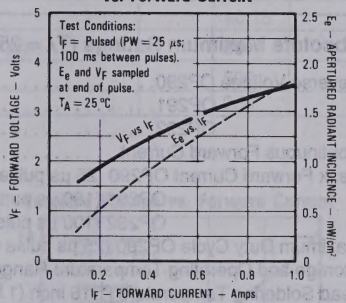


**Typical Performance Curves**

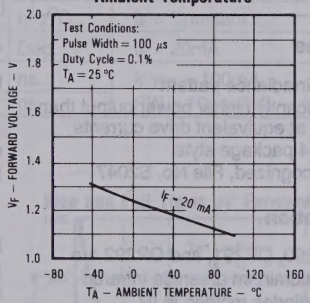
**Forward Voltage vs. Forward Current**



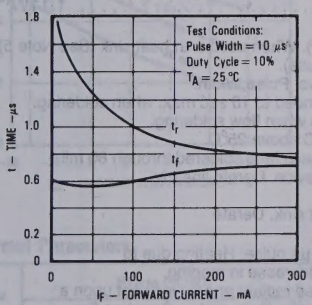

**Forward Voltage and Radiant Incidence vs. Forward Current**


Test Conditions:
$I_F$ = Pulsed (PW = 25 µs; 100 ms between pulses).
$E_e$ and $V_F$ sampled at end of pulse.
$T_A$ = 25 °C
$V_F$ vs $I_F$
$E_e$ vs $I_F$
$V_F$ – FORWARD VOLTAGE – Volts
$E_e$ – APERTURED RADIANT INCIDENCE – mW/cm$^2$
$I_F$ – FORWARD CURRENT – Amps

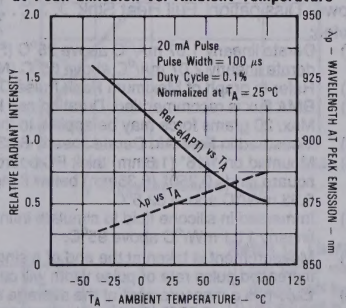
**Forward Voltage vs. Ambient Temperature**



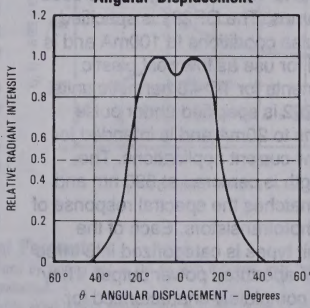

**Rise Time and Fall Time vs. Forward Current**




**Relative Radiant Intensity and Wavelength at Peak Emission vs. Ambient Temperature**

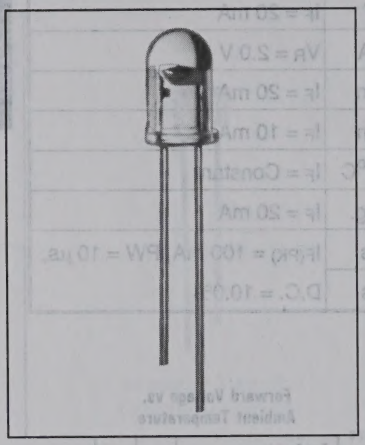

20 mA Pulse
Pulse Width = 100 µs
Duty Cycle = 0.1%
Normalized at $T_A$ = 25 °C
Rel $E_{e(APT)}$ vs $T_A$
λp vs $T_A$
RELATIVE RADIANT INTENSITY
λp – WAVELENGTH AT PEAK EMISSION – nm
$T_A$ – AMBIENT TEMPERATURE – °C

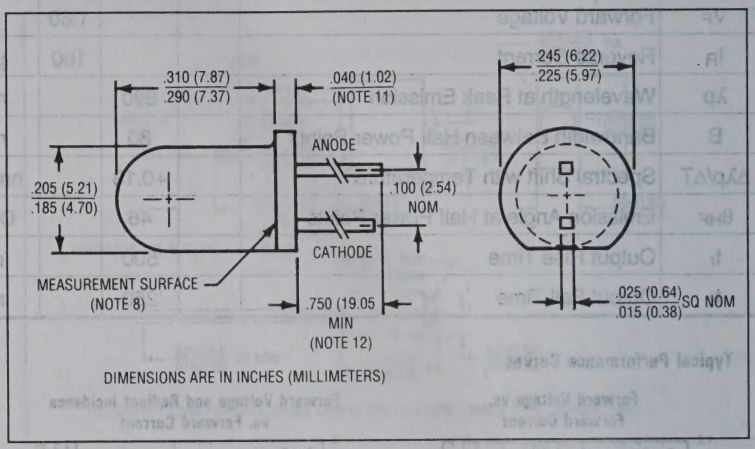
**Relative Radiant Intensity vs. Angular Displacement**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# GaAlAs Plastic Infrared Emitting Diodes
## Types OP290, OP291, OP292 Series






### Features

- Wide irradiance pattern
- Significantly higher power output than GaAs at equivalent drive currents
- T-1 3/4 package style
- UL recognized, File No. S2047

### Description

The OP290, OP291, and OP292 are gallium aluminum arsenide infrared emitting diodes molded in IR transmissive plastic packages. The OP290 is specified under pulse conditions to 1.5 amps and can be used up to 5 amps. The OP291 is specified under pulse conditions to 100mA and is intended for use as low cost plastic replacements for TO-46 hermetic units. The OP292 is specified under pulse conditions to 20mA and is intended for use in low current applications. The wavelength is centered at 890 nm and closely matches the spectral response of silicon phototransistors. Each of the these unit types is categorized into three ranges of apertured power output. They are also completely characterized for ease of system design. Silver-copper lead frames offer excellent thermal characteristics.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage OP290 | 5.0V |
| OP291 | 2.0V |
| OP292 | 5.0V |
| Continuous Forward Current | 150mA(1) |
| Peak Forward Current OP290 (25 µs pulse width) | 5.0A |
| OP291 (100 µs pulse width) | 2.0A |
| OP292 (100 µs pulse width) | 1.00A |
| Maximum Duty Cycle OP290 (25 µs pulse width, @ 5 A) | 1.25%(2) |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec with soldering iron] | 260°C(3) |
| Power Dissipation, Free Air | 333mW(4) |
| Power Dissipation, Board Mounted | 533mW(5) |
| Power Dissipation, Full Heat Sink | 1.11W(6) |

**Notes:**

(1) Derate linearly 1.67 mA/°C above 25°C (Free-Air). When used with heat sink (See Note 5) derate linearly 2.07 mA/°C above 65°C (Normal use).
(2) Refer to graph of Maximum Peak Pulse Current vs. Pulse Width.
(3) RMA flux is recommended. Duration can be extended to 10 sec max. when soldering. Max. 20 grams force may be applied to the leads when flow soldering.
(4) Measured in Free-Air. Derate linearly 3.33 mW/°C above 25°C.
(5) Mounted on 1/16" (1.6mm) thick PC board with each lead soldered through 80 mil square lands 0.250" (6.35mm) below flange of device. Derate linearly 5.33 mW/°C above 62.5°C.
(6) Immersed in silicone fluid to simulate infinite heat sink. Derate linearly 11.1 mW/°C above 95°C.
(7) Measurement is taken at the end of a single 100 µs pulse. Heating due to increased pulse rate or pulse width will cause a decrease in reading.
(8) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250" (6.35mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 0.500" (12.7mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(9) Typical total Power Out ($P_O$) @ $I_F$ = 20mA pulsed all units is 3.6mW, @ $I_F$ = 100mA is 19mW, and @ $I_F$ = 1.5 A is 240mW.
(10) Measured at the end of a 10 msec. voltage soak.
(11) This dimension is held to within ± 0.005" on the flange edge and may vary ± 0.020" in the area of the leads.
(12) Cathode lead is 0.070" nom shorter than anode lead.

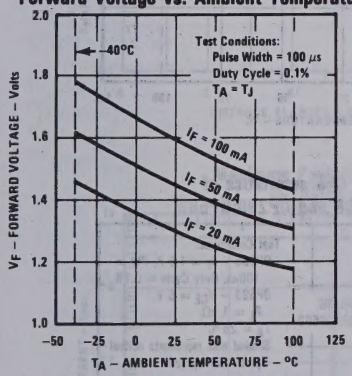
# Types OP290, OP291, OP292 Series

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

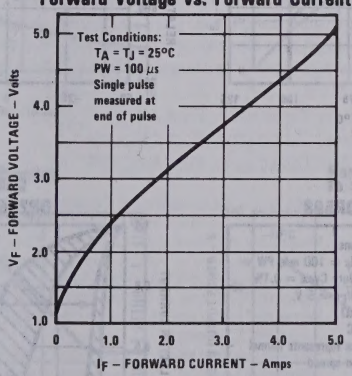
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence* | OP290C | 150 | | | mW/cm² | $I_F$ = 1.50A(7)(8)(9) |
| | | OP290B | 180 | | 300 | mW/cm² | $I_F$ = 1.50A(7)(8)(9) |
| | | OP290A | 210 | | | mW/cm² | $I_F$ = 1.50A(7)(8)(9) |
| | * OP290 series is measured into a 30° cone with the aperture 0.5" from the device measurement surface. | OP291C | 10.0 | | | mW/cm² | $I_F$ = 100mA(7)(8)(9) |
| | | OP291B | 13.0 | | 26.0 | mW/cm² | $I_F$ = 100mA(7)(8)(9) |
| | | OP291A | 16.0 | | | mW/cm² | $I_F$ = 100mA(7)(8)(9) |
| | | OP292C | 1.7 | | | mW/cm² | $I_F$ = 20mA(7)(8)(9) |
| | | OP292B | 2.2 | | 4.4 | mW/cm² | $I_F$ = 20mA(7)(8)(9) |
| | | OP292A | 2.7 | | | mW/cm² | $I_F$ = 20mA(7)(8)(9) |
| $V_F$ | Forward Voltage | OP290 | | | 4.00 | V | $I_F$ = 1.50A(7) |
| | | OP291 | | | 2.00 | V | $I_F$ = 100mA(7) |
| | | OP292 | | | 1.75 | V | $I_F$ = 20mA(7) |
| $I_R$ | Reverse Current | OP290/OP292 | | | 10 | µA | $V_R$ = 5.0V(10) |
| | | OP291 | | | 100 | µA | $V_R$ = 2.0V(10) |
| λp | Wavelength at Peak Emission | | | 890 | | nm | $I_F$ = 10mA |
| B | Spectral Bandwidth Between Half Power Points | | | 80 | | nm | $I_F$ = 10mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.18 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 50 | | Deg. | $I_F$ = 20mA |
| $t_r$ | Output Rise Time | | | 500 | | ns | $I_{F(PK)}$ = 100mA, PW = 10µs, D.C. = 10.0% |
| $t_f$ | Output Fall Time | | | 250 | | ns | |

## Typical Performance Curves

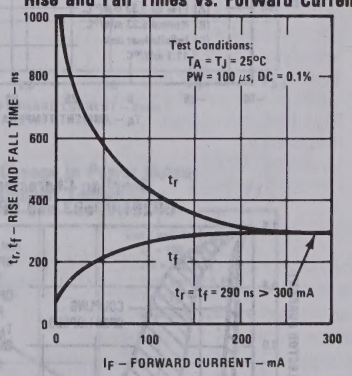
**Forward Voltage vs. Ambient Temperature**




**Forward Voltage vs. Forward Current**




**Rise and Fall Times vs. Forward Current**




## Thermal Parameters

| Type Units | $R_{THJA}$ (°C/W) Free Air(1) | Normal(2) | Infinite Heat Sink(3) | $C_{TH}$ ($10^{-5}$ Ws/°C) | $\tau_{TH}$ ($10^{-2}$ s) | K |
|---|---|---|---|---|---|---|
| All | 300 | 188 | 90 | 1.42 | 0.263 | 0.008 |

Refer to Application Bulletin 105 for use of these constants.

## Notes to Thermal Parameters

(1) Heat transfer minimized by holding unit in still air with minimum heat transferred through leads by conduction.

(2) Unit mounted in double sided printed circuit board ≈ 0.250 inches (6.35 mm) below plastic. The land areas are 0.080 inches square. This simulates normal use.

(3) Unit immersed in circulating silicone fluid holding $T_{CASE}$ = 25°C. This simulates an infinite heat sink.

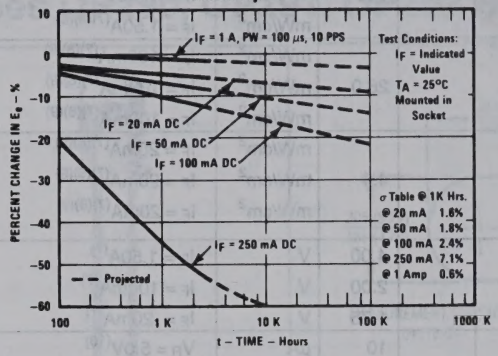


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

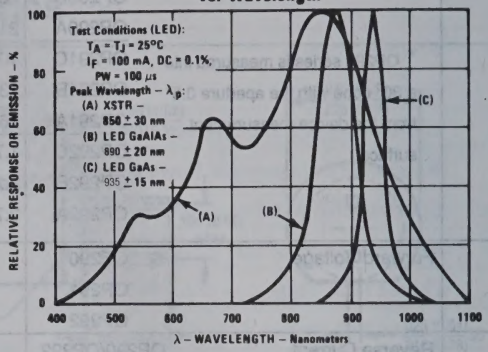
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

## Typical Performance Curves

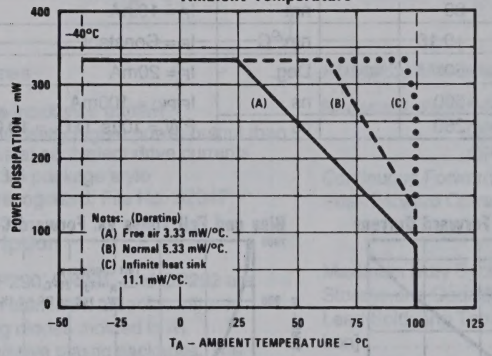
### Percent Change in Radiant Intensity vs. Time


PERCENT CHANGE IN $E_e$ – %
t – TIME – Hours
$I_F$ = 1 A, PW = 100 μs, 10 PPS
$I_F$ = 20 mA DC
$I_F$ = 50 mA DC
$I_F$ = 100 mA DC
$I_F$ = 250 mA DC
Projected
Test Conditions:
$I_F$ = Indicated Value
$T_A$ = 25°C
Mounted in Socket
σ Table @ 1K Hrs.
@ 20 mA 1.6%
@ 50 mA 1.8%
@ 100 mA 2.4%
@ 250 mA 7.1%
@ 1 Amp 0.6%

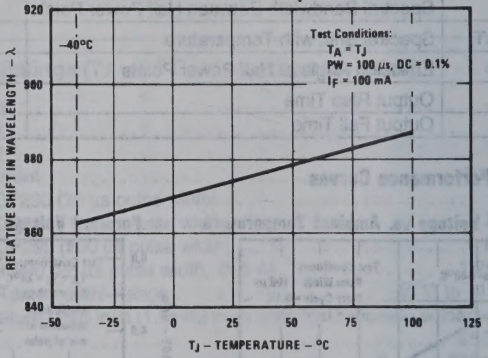
### Spectral Response and Emission vs. Wavelength


RELATIVE RESPONSE OR EMISSION – %
λ – WAVELENGTH – Nanometers
Test Conditions (LED):
$T_A = T_J$ = 25°C
$I_F$ = 100 mA, DC = 0.1%,
PW = 100 μs
Peak Wavelength – $\lambda_p$:
(A) XSTR – 850 ± 30 nm
(B) LED GaAlAs – 890 ± 20 nm
(C) LED GaAs – 935 ± 15 nm

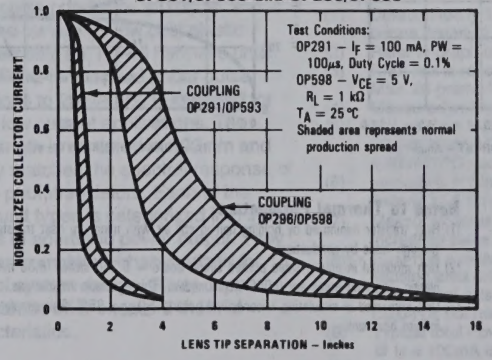
### Power Dissipation vs. Ambient Temperature



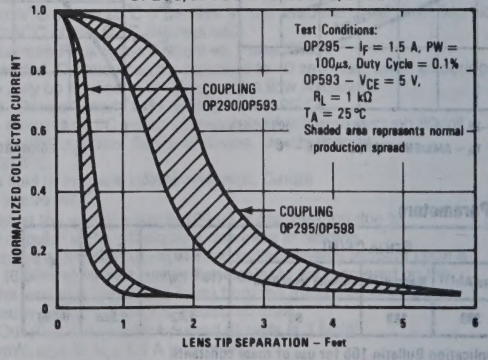

### Shift in Peak Wavelength vs. Junction Temperature




### Coupling Characteristics of OP291/OP593 and OP296/OP598

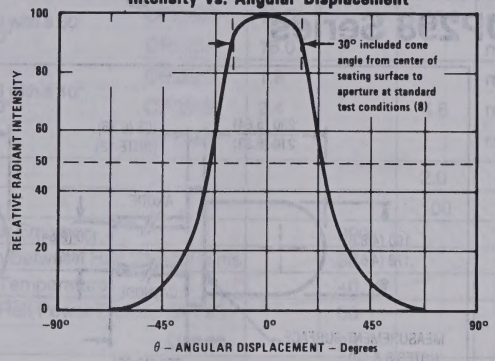

NORMALIZED COLLECTOR CURRENT
LENS TIP SEPARATION – Inches
COUPLING OP291/OP593
COUPLING OP296/OP598
Test Conditions:
OP291 – $I_F$ = 100 mA, PW = 100μs, Duty Cycle = 0.1%
OP598 – $V_{CE}$ = 5 V,
$R_L$ = 1 kΩ
$T_A$ = 25 °C
Shaded area represents normal production spread

### Coupling Characteristics of OP295/OP598 and OP290/OP593

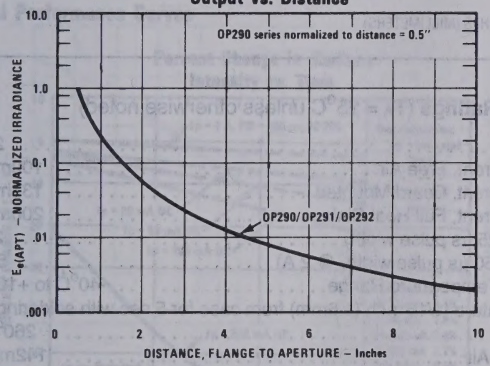

NORMALIZED COLLECTOR CURRENT
LENS TIP SEPARATION – Feet
COUPLING OP290/OP593
COUPLING OP295/OP598
Test Conditions:
OP295 – $I_F$ = 1.5 A, PW = 100μs, Duty Cycle = 0.1%
OP593 – $V_{CE}$ = 5 V,
$R_L$ = 1 kΩ
$T_A$ = 25 °C
Shaded area represents normal production spread

## Typical Performance Curves

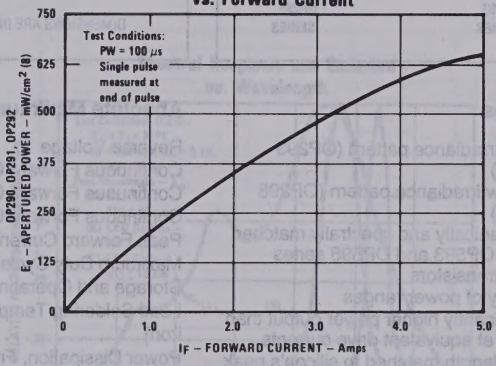
### OP290/OP291/OP292 Relative Radiant Intensity vs. Angular Displacement



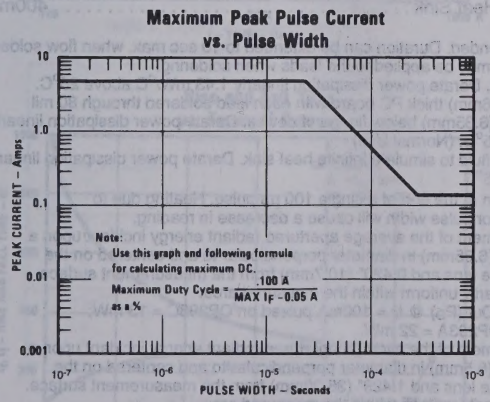

### Percent Change in Apertured Power Output vs. Distance



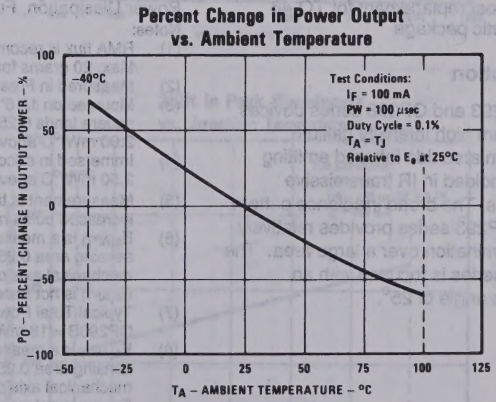

### Power Output or Radiant Incidence vs. Forward Current




### Maximum Peak Pulse Current vs. Pulse Width

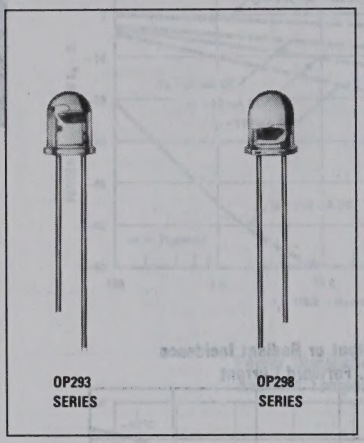


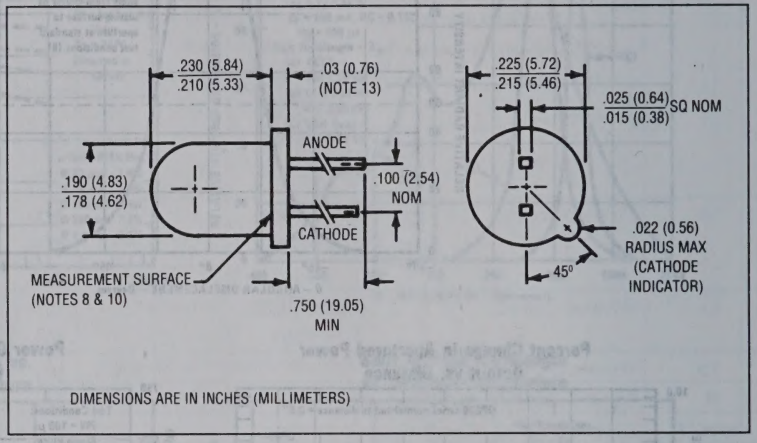

### Percent Change in Power Output vs. Ambient Temperature




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# GaAlAs Plastic Infrared Emitting Diodes
## Types OP293 and OP298 Series




### Features

- Wide irradiance pattern (OP293 series)
- Narrow irradiance pattern (OP298 series)
- Mechanically and spectrally matched to the OP593 and OP598 series phototransistors
- Variety of power ranges
- Significantly higher power output than GaAs at equivalent drive currents
- Wavelength matched to silicon's peak response
- Low cost replacement for TO-46 hermetic package

### Description

The OP293 and OP298 series devices are 890nm high intensity gallium aluminum arsenide infrared emitting diodes molded in IR transmissive packages. The broad irradiance pattern of the OP293 series provides relatively even illumination over a large area. The OP298 series is focused with an emission angle of 25°.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current, Free Air | 100mA(2) |
| Continuous Forward Current, Board Mounted | 133mA(3) |
| Continuous Forward Current, Full Heat Sink | 200mA(4) |
| Peak Forward Current (25 µs pulse width) | 2.0A |
| Maximum Duty Cycle (250 µs pulse width, @ 2 A) | 5.0% |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec with soldering iron] | 260°C(1) |
| Power Dissipation, Free Air | 142mW(2) |
| Power Dissipation, Board Mounted | 200mW(3) |
| Power Dissipation, Full Heat Sink | 400mW(4) |

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec max. when flow soldering. Max. 20 grams force may be applied to the leads when soldering.
(2) Measured in Free-Air. Derate power dissipation linearly 1.43 mW/°C above 25°C.
(3) Mounted on 1/16" (1.6mm) thick PC board with each lead soldered through 80 mil square lands 0.250" (6.35mm) below flange of device. Derate power dissipation linearly 2.00 mW/°C above 25°C. (Normal Use)
(4) Immersed in silicone fluid to simulate infinite heat sink. Derate power dissipation linearly 2.50 mW/°C above 25°C.
(5) Measurement is taken at the end of a single 100 µs pulse. Heating due to increased pulse rate or pulse width will cause a decrease in reading.
(6) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250" (6.35mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 0.420" (10.7mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(7) Typical Total Power Out ($P_O$) @ $I_F$ = 100mA pulsed on OP293C = 13 mW; OP293B = 18 mW; OP293A = 22 mW.
(8) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250" (6.5mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 1.429" (36.30mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(9) For press fit, drill 0.184 ± 0.001" diameter hole.
(10) This dimension is held to within ± 0.005" on the flange edge and may vary ± 0.020" in the area of the leads.
(11) Cathode lead is 0.070" nom shorter than anode lead.

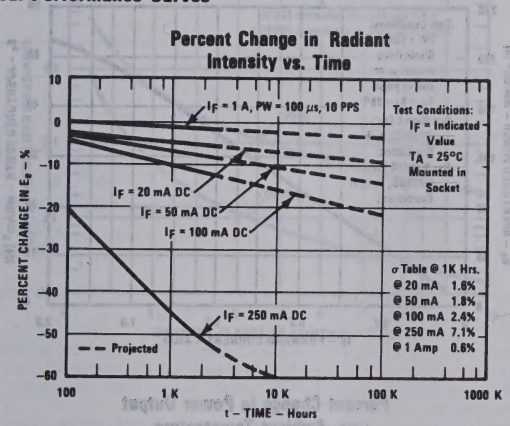
# Types OP293 and OP298 Series

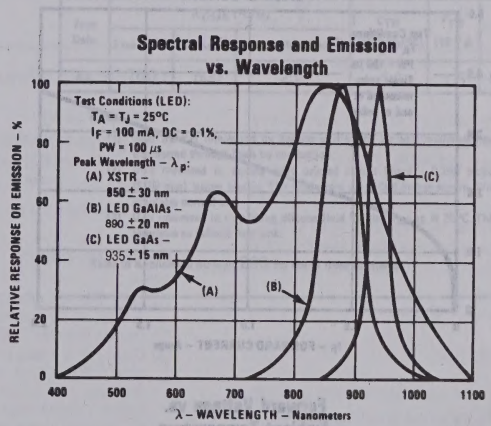
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

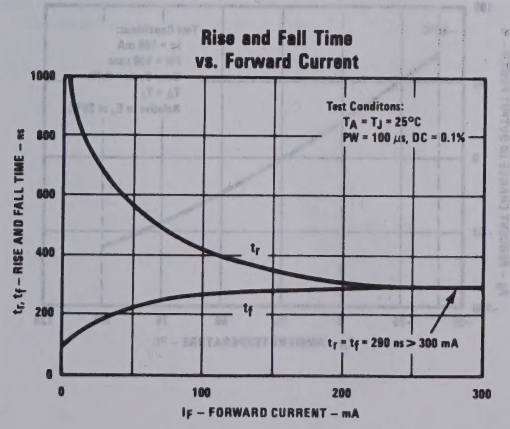
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence* | OP293C | 10.0 | | | mW/cm² | $I_F$ = 100mA(5)(6)(7) |
| | *OP293 is measured with a 30° cone angle at 0.420" | OP293B | 13.0 | | 26.0 | mW/cm² | $I_F$ = 100mA(5)(6)(7) |
| | | OP293A | 16.0 | | | mW/cm² | $I_F$ = 100mA(5)(6)(7) |
| | *OP298 is measured with a 10° cone angle at 1.429" | OP298C | 1.8 | | | mW/cm² | $I_F$ = 100mA(5)(7)(8) |
| | | OP298B | 2.4 | | 4.8 | mW/cm² | $I_F$ = 100mA(5)(7)(8) |
| | | OP298A | 3.0 | | | mW/cm² | $I_F$ = 100mA(5)(7)(8) |
| $V_F$ | Forward Voltage | | | | 2.0 | V | $I_F$ = 100mA(5) |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0V |
| λp | Wavelength at Peak Emission | | | 890 | | nm | $I_F$ = 10mA |
| B | Spectral Bandwidth Between Half Power Points | | | 80 | | nm | $I_F$ = 10mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.18 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | OP293 | | 60 | | Deg. | $I_F$ = 20mA |
| | | OP298 | | 25 | | Deg. | $I_F$ = 20mA |
| $t_r$ | Output Rise Time | | | 500 | | ns | $I_{F(PK)}$ = 100mA, PW = 10µs, D.C. = 10.0% |
| $t_f$ | Output Fall Time | | | 250 | | ns | |

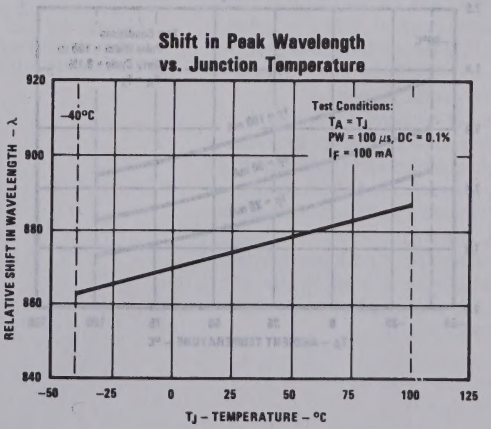


## Typical Performance Curves


Percent Change in Radiant Intensity vs. Time
PERCENT CHANGE IN $E_e$ – %
t – TIME – Hours
$I_F$ = 1 A, PW = 100 µs, 10 PPS
Test Conditions:
$I_F$ = Indicated Value
$T_A$ = 25°C
Mounted in Socket
$I_F$ = 20 mA DC
$I_F$ = 50 mA DC
$I_F$ = 100 mA DC
$I_F$ = 250 mA DC
Projected
σ Table @ 1K Hrs.
@ 20 mA 1.6%
@ 50 mA 1.8%
@ 100 mA 2.4%
@ 250 mA 7.1%
@ 1 Amp 0.6%


Spectral Response and Emission vs. Wavelength
RELATIVE RESPONSE OR EMISSION – %
λ – WAVELENGTH – Nanometers
Test Conditions (LED):
$T_A$ = $T_J$ = 25°C
$I_F$ = 100 mA, DC = 0.1%,
PW = 100 µs
Peak Wavelength – $\lambda_p$:
(A) XSTR – 850 ± 30 nm
(B) LED GaAlAs – 890 ± 20 nm
(C) LED GaAs – 935 ± 15 nm
(A)
(B)
(C)

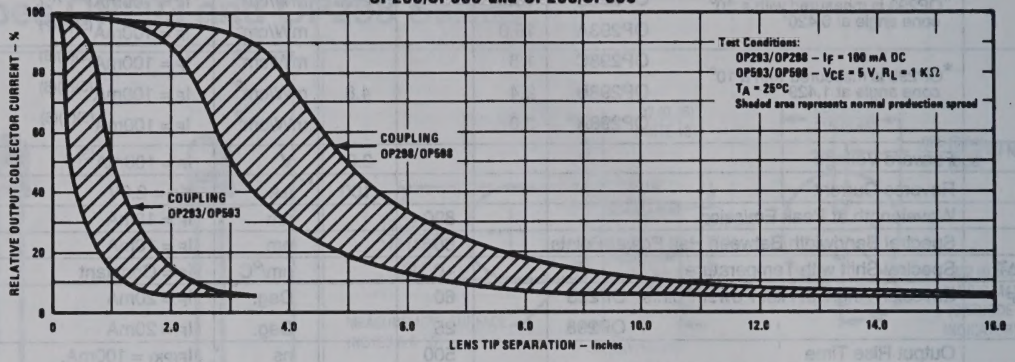

Rise and Fall Time vs. Forward Current
$t_r$, $t_f$ – RISE AND FALL TIME – ns
$I_F$ – FORWARD CURRENT – mA
Test Conditons:
$T_A$ = $T_J$ = 25°C
PW = 100 µs, DC = 0.1%
$t_r$
$t_f$
$t_r$ = $t_f$ = 280 ns > 300 mA


Shift in Peak Wavelength vs. Junction Temperature
RELATIVE SHIFT IN WAVELENGTH – λ
$T_J$ – TEMPERATURE – °C
–40°C
Test Conditions:
$T_A$ = $T_J$
PW = 100 µs, DC = 0.1%
$I_F$ = 100 mA

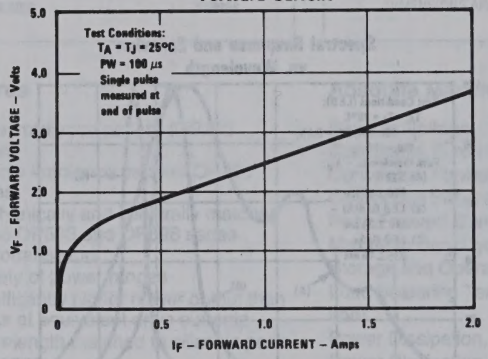
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

## Typical Performance Curves

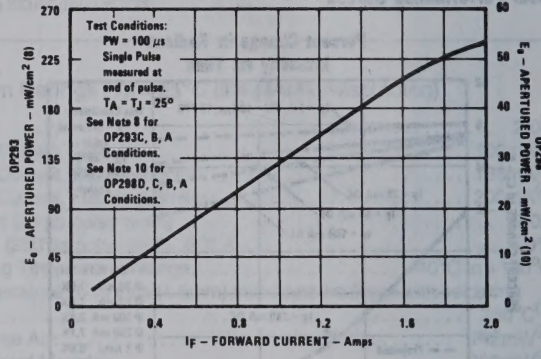
### Coupling Characteristics of OP293/OP593 and OP298/OP598


RELATIVE OUTPUT COLLECTOR CURRENT – %
LENS TIP SEPARATION – Inches
Test Conditions:
OP293/OP298 – IF = 100 mA DC
OP593/OP598 – VCE = 5 V, RL = 1 KΩ
TA = 25°C
Shaded area represents normal production spread
COUPLING OP298/OP598
COUPLING OP293/OP593

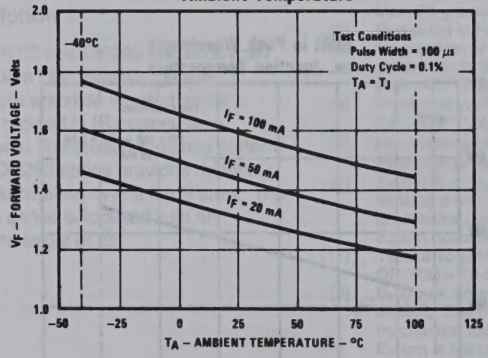
### Forward Voltage vs. Forward Current


VF – FORWARD VOLTAGE – Volts
IF – FORWARD CURRENT – Amps
Test Conditions:
TA = TJ = 25°C
PW = 100 µs
Single pulse measured at end of pulse

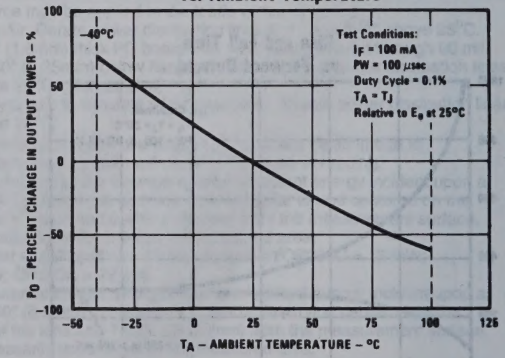
### Apertured Power OP293/OP298 vs. Forward Current


Ee – APERTURED POWER – mW/cm² (8)
Ee – APERTURED POWER – mW/cm² (10)
OP293
OP298
IF – FORWARD CURRENT – Amps
Test Conditions:
PW = 100 µs
Single Pulse measured at end of pulse.
TA = TJ = 25°
See Note 8 for OP293C, B, A Conditions.
See Note 10 for OP298D, C, B, A Conditions.

### Forward Voltage vs. Ambient Temperature

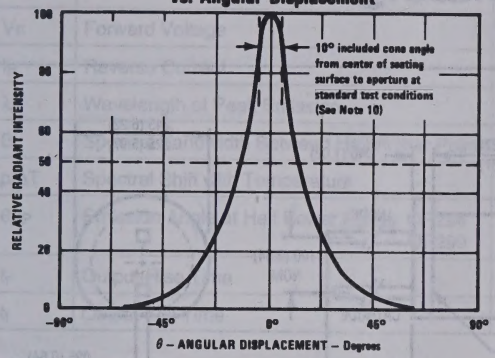



### Percent Change in Power Output vs. Ambient Temperature

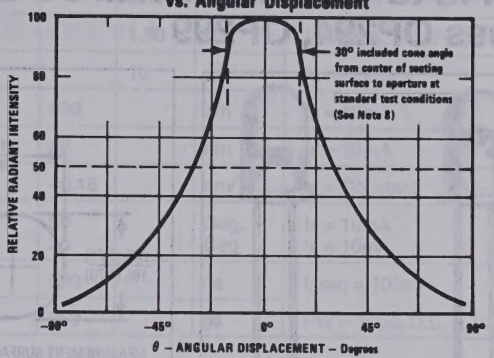

PO – PERCENT CHANGE IN OUTPUT POWER – %
TA – AMBIENT TEMPERATURE – °C
–40°C
Test Conditions:
IF = 100 mA
PW = 100 µsec
Duty Cycle = 0.1%
TA = TJ
Relative to Ee at 25°C

## Typical Performance Curves

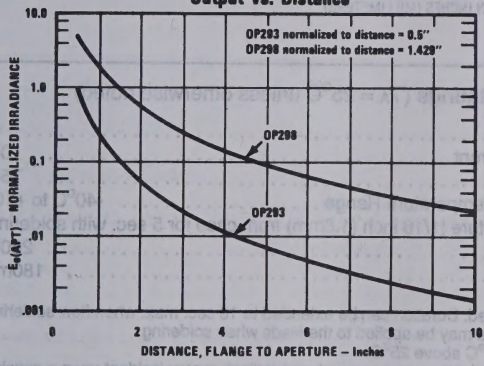
**OP298 – Relative Radiant Intensity vs. Angular Displacement**




**OP293 – Relative Radiant Intensity vs. Angular Displacement**




**Percent Change in Apertured Power Output vs. Distance**




**Thermal Parameters**

| Type Units | $R_{THJA}$ (°C/W) Free Air(1) | Normal(2) | Infinite Heat Sink(3) | $C_{TH}$ ($10^{-5}$ Ws/°C) | $\tau_{TH}$ ($10^{-2}$ s) | K |
|---|---|---|---|---|---|---|
| All | 700 | 500 | 250 | 4.0 | 1.5 | 0.008 |

Notes:

(1) Heat transfer minimized by holding unit in still air with minimum heat transferred through leads by conduction.

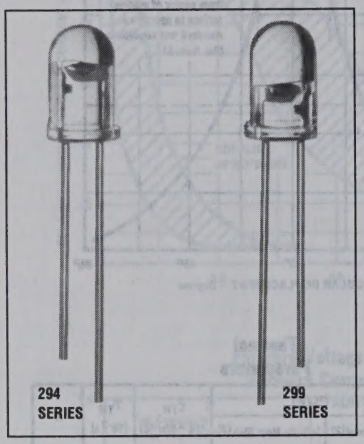
(2) Unit mounted in double sided printed circuit board 0.250 inches (6.35 mm) below plastic. The land areas are 0.080 inches square. This simulates normal use.

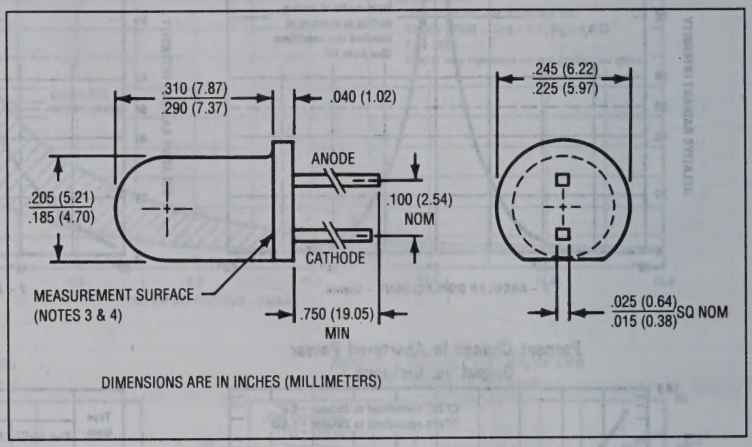
(3) Unit immersed in circulating silicone fluid holding $T_{CASE}$ @ 25°C. This simulates an infinite heat sink.

Refer to Application Bulletin 200 for use of these constants.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# GaAlAs Plastic Infrared Emitting Diode
## Types OP294, OP299




### Features

- Characterized at 5mA for battery operated systems or other low drive current systems
- Wide irradiance pattern (OP294) or narrow irradiance pattern (OP299)
- Significantly higher power output than GaAs at equivalent drive currents
- Wavelength matched to silicon's peak response
- T-1 3/4 package

### Description

The OP294 and OP299 are gallium arsenide infrared emitting diodes designed for low current or power limited applications (such as battery supplies). These LEDs are similar in design to the OP290 and OP295 but use a smaller chip which increases output efficiency at low current levels by increasing current density. Light output can be maximized with continuous (d.c.) forward current up to 100mA or with pulsed forward current operation up to 750mA. The chip is mounted in an IR transmissive plastic package and has been designed and tested for use with OP593/598 phototransistors or similar photodetector.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 5.0V |
| Continuous Forward Current | 100mA |
| Peak Forward Current | 750mA |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 180mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.80mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250" (6.35 mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 1.429" (36.3 mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(4) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250" (6.35 mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and .500" (12.7 mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(5) Cathode lead is 0.070" nom shorter than anode lead.

# Types OP294, OP299

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

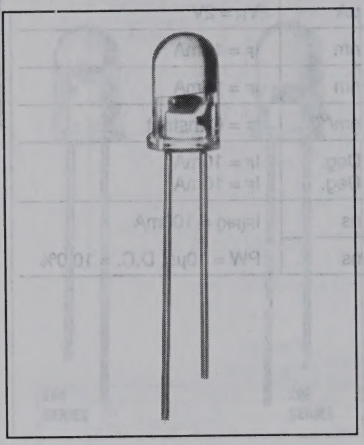
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence | OP294<br>OP299 | 0.50<br>0.15 | | 1.50<br>0.45 | $mW/cm^2$<br>$mW/cm^2$ | $I_F$ = 5mA(4)<br>$I_F$ = 5mA(3) |
| $V_F$ | Forward Voltage | | | | 1.50 | V | $I_F$ = 5mA |
| $I_R$ | Reverse Current | | | | 10 | µA | $V_R$ = 2V |
| λp | Wavelength at Peak Emission | | | 890 | | nm | $I_F$ = 10mA |
| B | Spectral Bandwidth Between Half Power Points | | | 80 | | nm | $I_F$ = 10mA |
| Δ λp/ΔT | Spectral Shift with Temperature | | | +0.18 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | OP294<br>OP299 | | 50<br>20 | | Deg.<br>Deg. | $I_F$ = 10mA<br>$I_F$ = 10mA |
| $t_r$ | Output Rise Time | | | 500 | | ns | $I_{F(PK)}$ = 100mA |
| $t_f$ | Output Fall Time | | | 250 | | ns | PW = 10µs, D.C. = 10.0% |

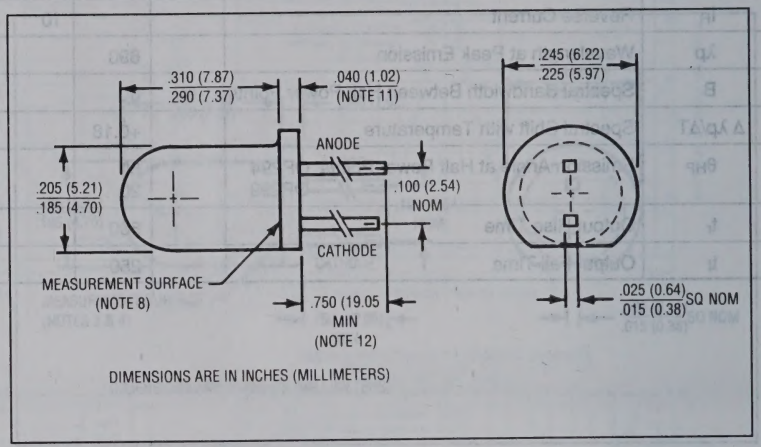


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# GaAlAs Plastic Infrared Emitting Diodes
## Types OP295, OP296, OP297 Series






### Features

- Narrow irradiance pattern
- Significantly higher power output than GaAs at equivalent drive currents
- Wavelength matched to silicon's peak response
- Excellent heat dissipation
- UL recognized, File No. S2047
- T-1 3/4 package style

### Description

The OP295, OP296, and OP297 are gallium aluminum arsenide infrared emitting diodes mounted in IR transmissive plastic packages. The OP295 is specified under pulse conditions to 1.5 amps and can be used up to 5 amps. The OP296 is specified under pulse conditions to 100mA and is intended for use as a low cost plastic replacement for TO-46 hermetic units. The OP297 is specified under pulse conditions to 20mA and is intended for use in low current applications. The wavelength is centered at 890 nm and closely matches the spectral response of silicon phototransistors. Each of these unit types are categorized into three ranges of apertured power output. They are also completely characterized for ease of system design. Silver-copper lead frames offer excellent thermal characteristics.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage OP295 | 5.0V |
| OP296 | 2.0V |
| OP297 | 5.0V |
| Continuous Forward Current | 150mA(1) |
| Peak Forward Current OP295 (25 µs pulse width) | 5.0A |
| OP296 (100 µs pulse width) | 2.0A |
| OP297 (100 µs pulse width) | 1.0A |
| Maximum Duty Cycle OP295 (25 µs pulse width, @ 5 A) | 1.25%(2) |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec with soldering iron] | 260°C(3) |
| Power Dissipation, Free Air | 333mW(4) |
| Power Dissipation, Board Mounted | 533mW(5) |
| Power Dissipation, Full Heat Sink | 1.11W(6) |

**Notes:**

(1) Derate linearly 1.67 mA/°C above 25°C (Free-Air). When used with heat sink (See Note 5) derate linearly 2.07 mA/°C above 65°C (Normal use).
(2) Refer to graph of Maximum Peak Pulse Current vs. Pulse Width.
(3) RMA flux is recommended. Duration can be extended to 10 sec max. when flow soldering. Max. 20 grams force may be applied to the leads when soldering.
(4) Measured in Free-Air. Derate linearly 3.33 mW/°C above 25°C.
(5) Mounted on 1/16" (1.6mm) thick PC board with each lead soldered through 80 mil square lands 0.250" (6.35mm) below flange of device. Derate linearly 5.33 mW/°C above 25°C.
(6) Immersed in silicone fluid to simulate infinite heat sink. Derate linearly 11.1 mW/°C above 25°C.
(7) Measurement is taken at the end of a single 100 µs pulse. Heating due to increased pulse rate or pulse width will cause a decrease in reading.
(8) Typical total Power Out ($P_O$) @ $I_F$ = 20mA pulsed all units is 3.6mW, @ $I_F$ = 100mA is 19mW, and @ $I_F$ = 1.5 A is 240mW.
(9) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250" (6.35mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 1.429" (36.30mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(10) Measured at the end of a 10 msec. voltage soak.
(11) This dimension is held to within ± 0.005" on the flange edge and may vary ± 0.020" in the area of the leads.
(12) Cathode lead is 0.070" nom shorter than anode lead.

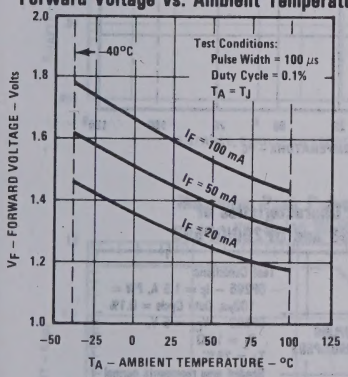
# Types OP295, OP296, OP297 Series

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

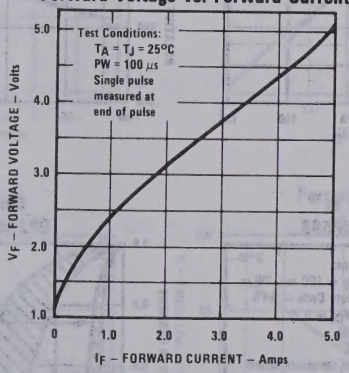
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence* | OP295C | 22 | | | mW/cm² | $I_F$ = 1.5A(7)(8)(9) |
| | | OP295B | 33 | | 77 | mW/cm² | $I_F$ = 1.5A(7)(8)(9) |
| | | OP295A | 44 | | | mW/cm² | $I_F$ = 1.5A(7)(8)(9) |
| | *OP295 series is measured into a 10° cone with the aperture 1.429" from the device measurement surface | OP296C | 1.6 | | | mW/cm² | $I_F$ = 100mA(7)(8)(9) |
| | | OP296B | 2.6 | | 6.6 | mW/cm² | $I_F$ = 100mA(7)(8)(9) |
| | | OP296A | 3.6 | | | mW/cm² | $I_F$ = 100mA(7)(8)(9) |
| | | OP297C | 0.30 | | | mW/cm² | $I_F$ = 20mA(7)(8)(9) |
| | | OP297B | 0.50 | | 1.30 | mW/cm² | $I_F$ = 20mA(7)(8)(9) |
| | | OP297A | 0.70 | | | mW/cm² | $I_F$ = 20mA(7)(8)(9) |
| $V_F$ | Forward Voltage | OP295 | | | 4.00 | V | $I_F$ = 1.50A(7) |
| | | OP296 | | | 2.00 | V | $I_F$ = 100mA(7) |
| | | OP297 | | | 1.75 | V | $I_F$ = 20mA(7) |
| $I_R$ | Reverse Current | OP295/297 | | | 10 | µA | $V_R$ = 5.0V(10) |
| | | OP296 | | | 100 | µA | $V_R$ = 2.0V(10) |
| λp | Wavelength at Peak Emission | | | 890 | | nm | $I_F$ = 10mA |
| B | Spectral Bandwidth Between Half Power Points | | | 80 | | nm | $I_F$ = 10mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | +0.18 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 20 | | Deg. | $I_F$ = 20mA |
| $t_r$ | Output Rise Time | | | 500 | | ns | $I_{F(PK)}$ = 100mA, PW = 10µs, D.C. = 10.0% |
| $t_f$ | Output Fall Time | | | 250 | | ns | |

## Typical Performance Curves

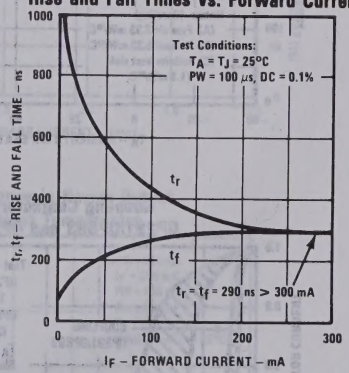
**Forward Voltage vs. Ambient Temperature**




**Forward Voltage vs. Forward Current**




**Rise and Fall Times vs. Forward Current**




## Thermal Parameters

| Type Units | $R_{THJA}$ (°C/W) Free Air(1) | Normal(2) | Infinite Heat Sink(3) | $C_{TH}$ ($10^{-5}$ Ws/°C) | $\tau_{TH}$ ($10^{-2}$ s) | K |
|---|---|---|---|---|---|---|
| All | 300 | 188 | 90 | 1.42 | 0.263 | 0.008 |

Refer to Application Bulletin 105 for use of these constants.

### Notes to Thermal Parameters

(1) Heat transfer minimized by holding unit in still air with minimum heat transferred through leads by conduction.

(2) Unit mounted in double sided printed circuit board ≈ 0.250 inches (6.35 mm) below plastic. The land areas are 0.080 inches square. This simulates normal use.

(3) Unit immersed in circulating silicone fluid holding $T_{CASE}$ = 25°C. This simulates an infinite heat sink.

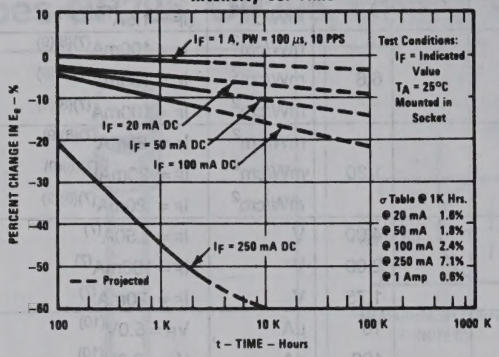


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

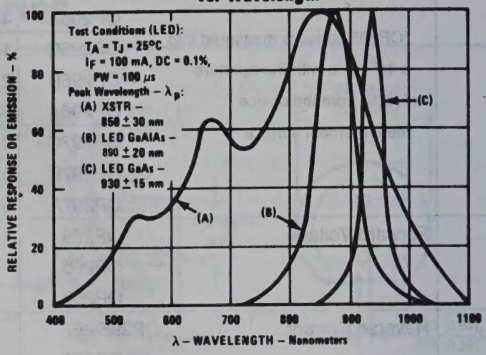
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

## Typical Performance Curves

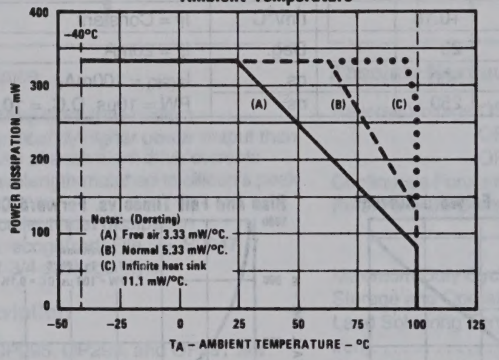
### Percent Change in Radiant Intensity vs. Time


$I_F$ = 1 A, PW = 100 µs, 10 PPS
Test Conditions:
$I_F$ = Indicated Value
$T_A$ = 25°C
Mounted in Socket
$I_F$ = 20 mA DC
$I_F$ = 50 mA DC
$I_F$ = 100 mA DC
$I_F$ = 250 mA DC
Projected
σ Table @ 1K Hrs.
@ 20 mA 1.6%
@ 50 mA 1.8%
@ 100 mA 2.4%
@ 250 mA 7.1%
@ 1 Amp 0.6%
PERCENT CHANGE IN $E_E$ – %
t – TIME – Hours

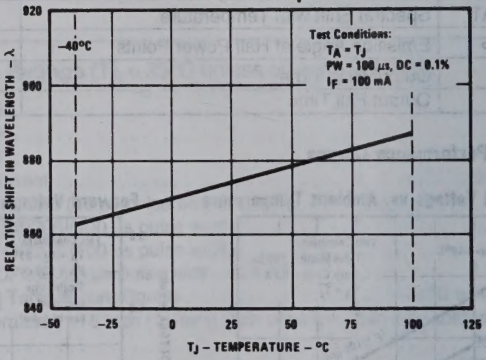
### Spectral Response and Emission vs. Wavelength


Test Conditions (LED):
$T_A = T_J$ = 25°C
$I_F$ = 100 mA, DC = 0.1%,
PW = 100 µs
Peak Wavelength – $\lambda_p$:
(A) XSTR – 850 ± 30 nm
(B) LED GaAlAs – 890 ± 20 nm
(C) LED GaAs – 930 ± 15 nm
RELATIVE RESPONSE OR EMISSION – %
λ – WAVELENGTH – Nanometers

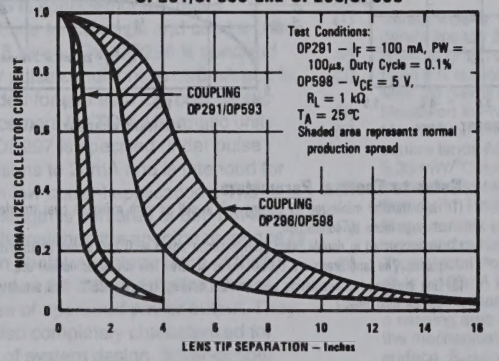
### Power Dissipation vs. Ambient Temperature


–40°C
Notes: (Derating)
(A) Free air 3.33 mW/°C.
(B) Normal 5.33 mW/°C.
(C) Infinite heat sink 11.1 mW/°C.
POWER DISSIPATION – mW
$T_A$ – AMBIENT TEMPERATURE – °C

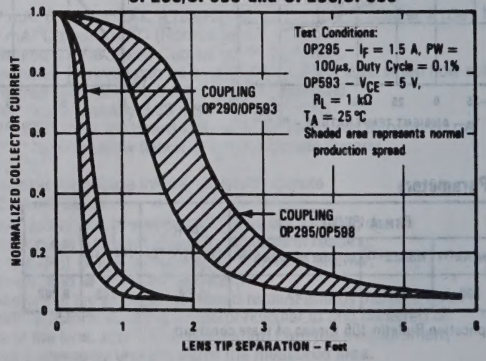
### Shift in Peak Wavelength vs. Junction Temperature




### Coupling Characteristics of OP291/OP593 and OP296/OP598

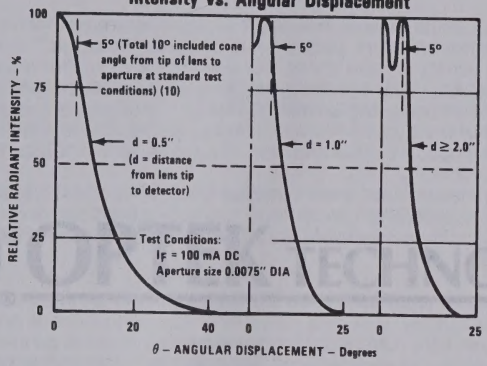

Test Conditions:
OP291 – $I_F$ = 100 mA, PW = 100µs, Duty Cycle = 0.1%
OP598 – $V_{CE}$ = 5 V, $R_L$ = 1 kΩ
$T_A$ = 25°C
Shaded area represents normal production spread
COUPLING OP291/OP593
COUPLING OP296/OP598
NORMALIZED COLLECTOR CURRENT
LENS TIP SEPARATION – Inches

### Coupling Characteristics of OP295/OP598 and OP290/OP593

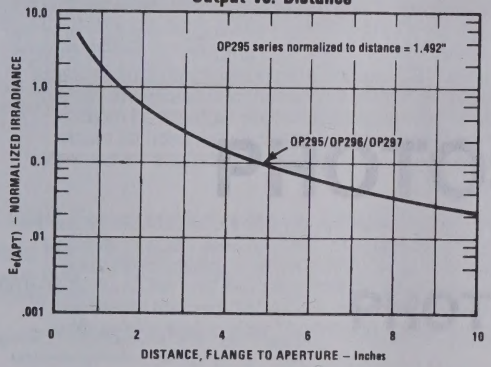

Test Conditions:
OP295 – $I_F$ = 1.5 A, PW = 100µs, Duty Cycle = 0.1%
OP593 – $V_{CE}$ = 5 V, $R_L$ = 1 kΩ
$T_A$ = 25°C
Shaded area represents normal production spread
COUPLING OP290/OP593
COUPLING OP295/OP598
NORMALIZED COLLECTOR CURRENT
LENS TIP SEPARATION – Feet

## Typical Performance Curves

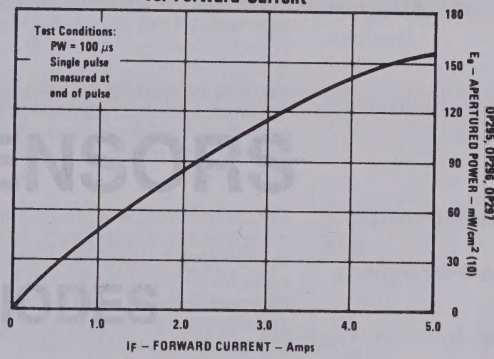
### OP295/OP298/OP297 Relative Radiant Intensity vs. Angular Displacement



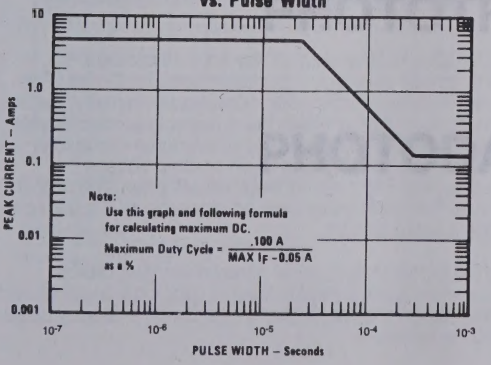

### Percent Change in Apertured Power Output vs. Distance



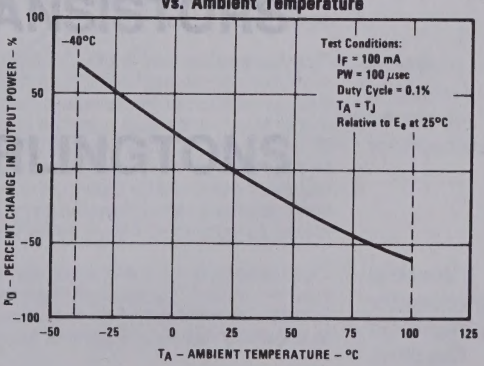

### Power Output or Radiant Incidence vs. Forward Current



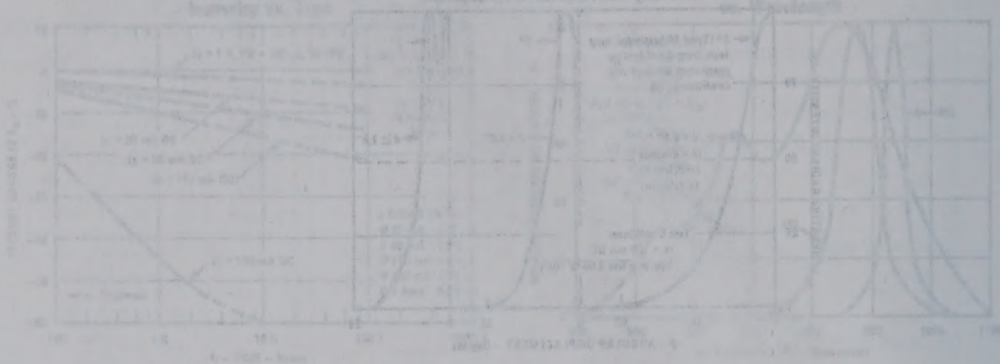

### Maximum Peak Pulse Current vs. Pulse Width

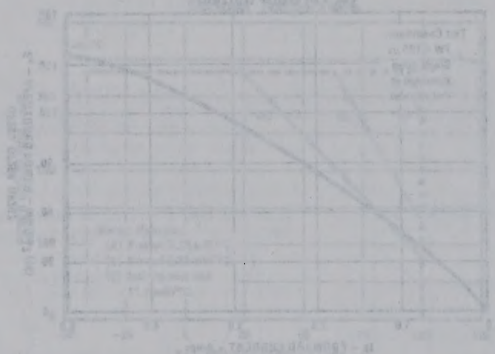


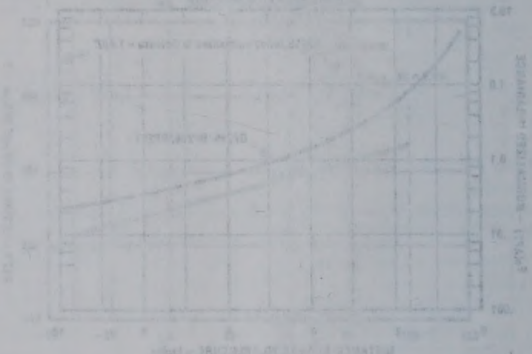

### Percent Change in Power Output vs. Ambient Temperature

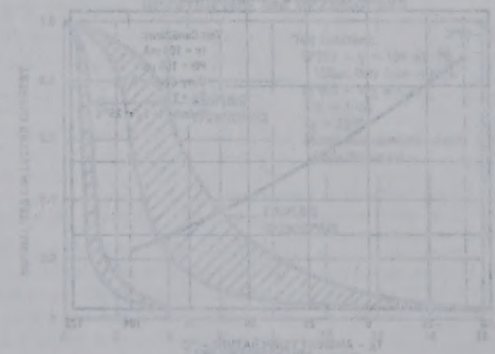


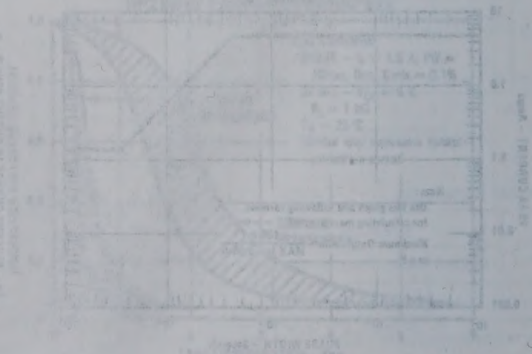

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.











OPTEK® TECHNOLOGY, INC.

# PHOTOSENSORS

## PHOTODIODES

## PHOTOTRANSISTORS

## PHOTODARLINGTONS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

**Selecting the Right Optek Sensor**

The Optek line of photosensors includes four basic infrared-sensitive device types: photodiodes, phototransistors, photodarlingtons and Photologic™ sensors. Each basic type is available in a variety of case styles. For every infrared emitter made by Optek, there is a mechanically and spectrally matched sensor. Case styles include several sizes of hermetic devices, and an even wider variety of plastic encapsulated types. Plastic versions of the popular hermetic T0-18 part are also available, offering improved optical design and drop-in replacement at substantial cost savings.

Important factors to consider when selecting the right device for an application are: operating speed required, available infrared energy, and the desired output current. Depending on the required balance of these design factors, Optek offers a choice of several appropriate types of photosensors.

**Photodiodes**

PN junction silicon photodiodes have the fastest operating speed of all the photosensors in the Optek product family. Rise and fall times of 100 nanoseconds are typical for these devices. However, light current ($I_C$) for these devices tends to be low; therefore, additional amplification is almost always required. Nevertheless, where speed considerations predominate, photodiodes are the best option. Figure 3 illustrates typical circuit requirements for the photoconductive and photovoltaic modes of operation.

**Photologic™ Devices**

Photologic™ is a term Optek uses to refer to complex integrated circuitry combined with a high speed, high sensitivity photodiode on a single silicon chip. Photologic™ devices offer the speed advantage of photodiodes along with a Schmitt trigger and amplifier to directly drive up to eight TTL loads. Medium speed data rates to 250 kbaud are possible with typical output rise and fall times of 25 nanoseconds. These devices are excellent choices where speed, accuracy and logic interface are required. Typical examples include high speed motion encoding, modulated (pulsed) long distance beam interrupt applications, such as touch screens, and track ball type devices for video games or "mouse" applications for computer accessories.

**Phototransistors and Photodarlingtons**

Phototransistors and photodarlingtons are Optek's most widely used photosensor types. For most traditional applications, NPN silicon phototransistors offer the best value in terms of output current, sensitivity, speed, reliability and quality. Devices with minimum on-state collector currents ranging up to 40 mA are available, while output rise and fall times of 60-100 microseconds ($R_L$=5 KΩ) are typical. Optek phototransistors are 100 percent tested and specified at light levels which range upwards from 1.00mW/cm$^2$ with collector-to-emitter voltage ($V_{CE}$) set at 5.0 volts.

Photodarlingtons provide the higher sensitivity and gain needed for many applications; however, rise and fall times are slower. When switching time is not critical, the choice of a photodarlington can offer improved sensing reliability and reduce the need for additional signal amplification.

**Optek Leadership in Advanced Photosensor**

Optek scientists and engineers continue to advance the state of the art in Photologic™ monolithic optoelectronic IC's, a product originally conceived and developed by Optek. The next generation of Photologic™ devices will include substantially increased sensitivity, making longer beam distances possible and offering even higher reliability at lower irradiance levels. Direct TTL and CMOS compatibility is also featured with increased sink/source capability. Supply voltage requirements are more flexible than before due to an on-chip voltage regulator designed by Optek. And finally, the new Photologic™ devices will offer a choice of two hysteresis ratios [$E_{eT}(+)/E_{eT}(-)$] of 2 and 1.4. With these new advancements, Optek continues its leadership role in advanced photosensor design.

**Spectral Matching for Improved Coupling Efficency**

Optek photosensors are spectrally matched to the Optek line of infrared emitting diodes. Figure 1 shows the spectral response curve for Optek phototransistors, photodarlingtons, and junction photodiodes. The output peak wavelengths for both GaAs and GaAlAs lie very close to the silicon sensitivity peak of about 850 nanometers.

## Controlling Ambient Light

The spectral response of silicon extends into the visible light range. This makes the sensors vulnerable to ambient light; particularly from tungsten sources (or the sun) where red light is present. In addition, many of Optek's slotted optical switches shield the sensor in an opaque housing designed to control ambient light. External light filters or controlled modulation of the LED and/or sensor may also be used to reduce the noise from ambient light. As another alternative, most photographic shops can supply infrared passing gelatin filters for laboratory experimentation. For production use, several types of plastic are commercially available with varying degrees of infrared and visible transmissivity (e.g., polysulfone and polycarbonate).

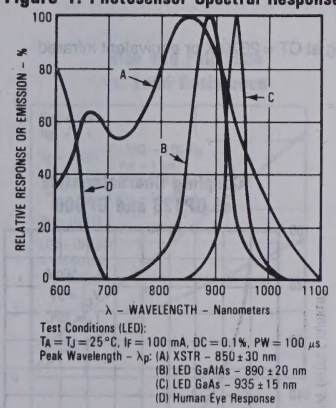
## Production Specifications Written for Easy Design

The product specifications in this book were written with ease of design in mind. Emitter output and sensor response levels are specified in terms of milliwatts per square centimeter at separation distances typical for most applications. In addition, as shown in Figure 2, phototransistor collector current versus collector-to-emitter voltage curves are provided for stepped levels of photocurrent (measured in $mW/cm^2$). These curves allow the design-in process to be analogous to the design of a simple transistor amplifier or switching circuit. The application notes appearing in the back of this data book also provide additional information.

## Custom Design and Selection for Unique Applications

While the Optek line is the industry's broadest, a unique application requirement may result in the need for custom selection or package design. Call your local Optek sales office for more information.

**Figure 1. Photosensor Spectral Response**




Test Conditions (LED):
$T_A = T_J = 25°C$, $I_F = 100$ mA, DC = 0.1%, PW = 100 µs
Peak Wavelength – $\lambda_P$: (A) XSTR – 850 ± 30 nm
(B) LED GaAlAs – 890 ± 20 nm
(C) LED GaAs – 935 ± 15 nm
(D) Human Eye Response

**Figure 2. Collector Current vs Collector to Emitter Voltage**

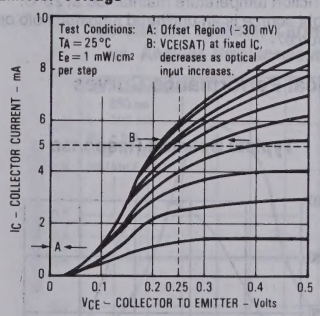
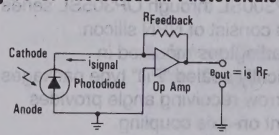
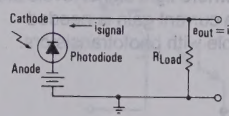



**Figure 3. Photodiode in Photovoltaic Mode**

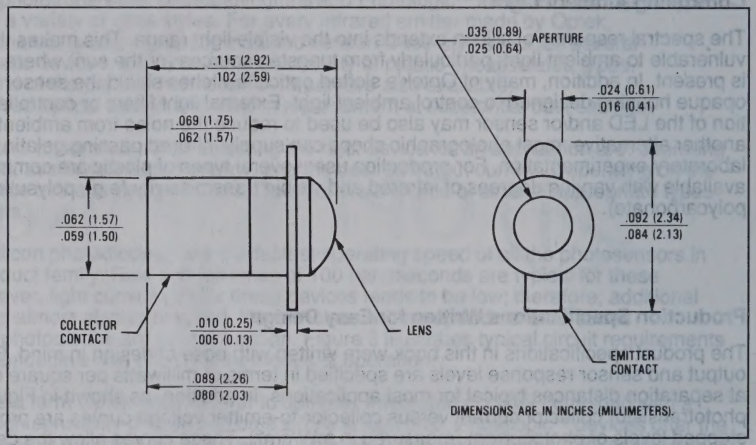



**Photodiode in Photoconductive Mode**



# NPN Silicon Photodarlingtons

## Types OP300SL, OP301SL, OP302SL, OP303SL, OP304SL, OP305SL




### Features

- Narrow receiving angle
- Variety of sensitivity ranges
- Enhanced temperature range
- High current gain
- Ideal for direct mounting in PC boards
- Mechanically and spectrally matched to the OP123 and OP223 series emitters

### Description

The OP300SL through OP305SL series devices consist of NPN silicon photodarlingtons mounted in hermetically sealed "Pill" type packages. The narrow receiving angle provides excellent on-axis coupling. Photodarlingtons are normally used in applications where light signal levels are low and more current gain is needed than is possible with phototransistors.

### Replaces

OP300 series

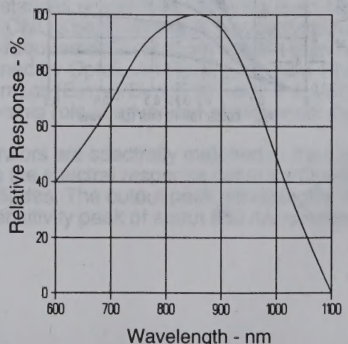
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 15.0V |
| Emitter-Collector Voltage | 5.0V |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Soldering Temperature (5 sec. with soldering iron) | 260°C(1)(2) |
| Power Dissipation | 50mW(3) |
| Continuous Collector Current | 50mA |

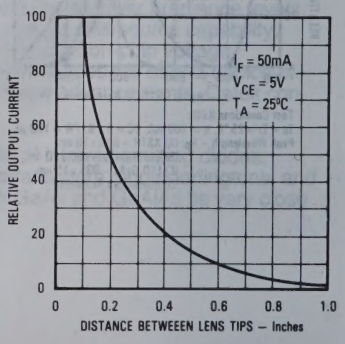
**Notes:**
(1) Refer to Application Bulletin 202 which discusses proper techniques for soldering Pill type devices to PC boards.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.5mW/°C above 25°C.
(4) Junction temperature maintained at 25°C.
(5) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP123 and OP300**



# Types OP300SL Thru OP305SL

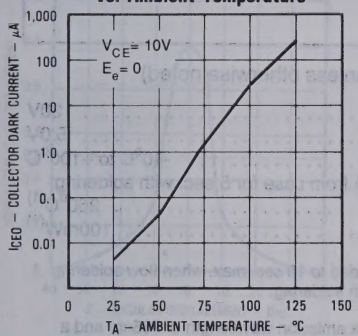
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$[4] | On-State Collector Current | OP300SL | 0.8 | | | mA | |
| | | OP301SL | 0.8 | | 2.4 | mA | |
| | | OP302SL | 1.8 | | 5.4 | mA | $V_{CE}$ = 5.0 V, |
| | | OP303SL | 3.6 | | 12.0 | mA | $E_e$ = 1.00 mW/cm²[5] |
| | | OP304SL | 7.0 | | 21.0 | mA | |
| | | OP305SL | 14.0 | | | mA | |
| $I_{CEO}$ | Collector Dark Current | | | | 1.00 | µA | $V_{CE}$ = 10.0 V, $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 15.0 | | | V | $I_C$ = 100 µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100 µA |
| $V_{CE(SAT)}$[4] | Collector-Emitter Saturation Voltage | OP300SL, OP301SL | | | 1.10 | V | $I_C$ = 0.4mA, $E_e$ = 1.0mW/cm²[5] |
| | | OP302SL thru OP305SL | | | 1.10 | V | $I_C$ = 1.0mA, $E_e$ = 1.0mW/cm²[5] |

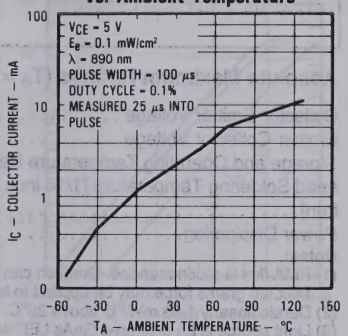
PHOTOSENSORS

## Typical Performance Curves

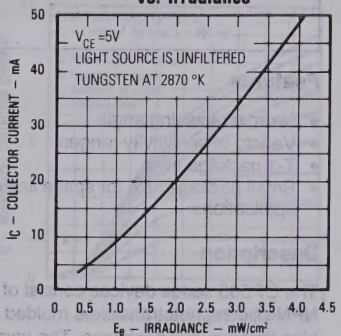
**Collector Dark Current vs. Ambient Temperature**



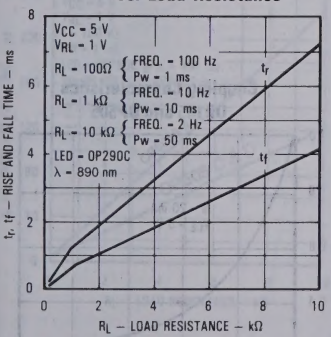

**Collector Current vs. Ambient Temperature**



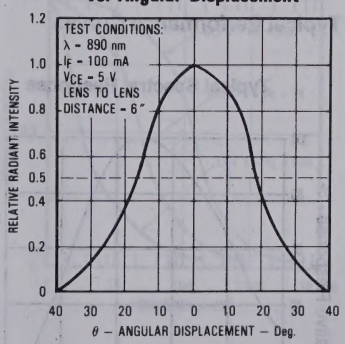

**Collector Current vs. Irradiance**



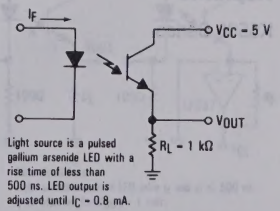

**Rise and Fall Time vs. Load Resistance**




**Normalized Collector Current vs. Angular Displacement**

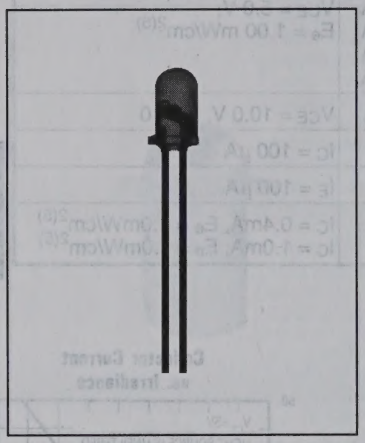


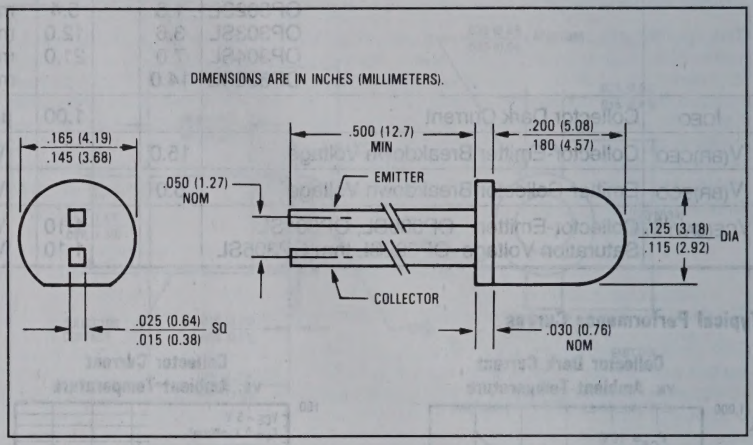

**Switching Time Test Circuit**


$I_F$
$V_{CC}$ = 5 V
$V_{OUT}$
$R_L$ = 1 kΩ
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until $I_C$ = 0.8 mA.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Infrared Selected NPN Silicon Phototransistors
## Types OP505A, OP505B, OP505C, OP505D






### Features

- Narrow receiving angle
- Variety of sensitivity ranges
- T-1 package style
- Small package size for space limited applications

### Description

The OP505 series devices consist of NPN silicon phototransistors molded in blue tinted epoxy packages. The narrow receiving angle provides excellent on-axis coupling. These devices are 100% production tested using infrared light for close correlation with Optek's GaAs and GaAlAs emitters.

### Replaces

K5500 Series

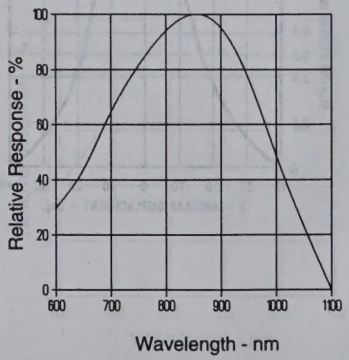
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

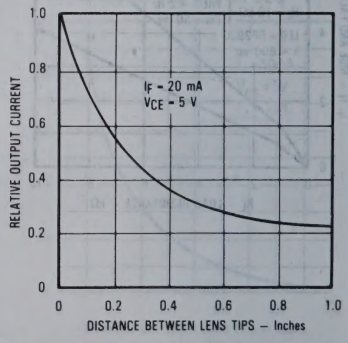
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) To calculate typical collector dark current in μA, use the formula $I_{CED} = 10^{(0.040\,T_A - 3.4)}$ where $T_A$ is ambient temperature in °C.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics OP165 and OP505**



# Types OP505A, OP505B, OP505C, OP505D

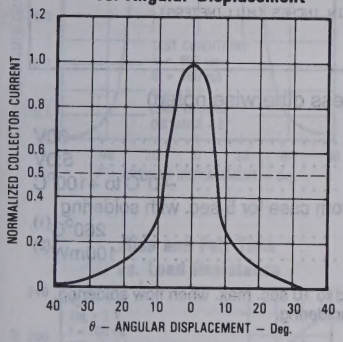
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$ | On-State Collector Current | OP505D | 0.55 | | | mA | $V_{CE}$ = 5V, $E_e$ = 0.50mW/cm$^2$[3] |
| | | OP505C | 1.10 | | 3.00 | mA | $V_{CE}$ = 5V, $E_e$ = 0.50mW/cm$^2$[3] |
| | | OP505B | 2.15 | | 5.95 | mA | $V_{CE}$ = 5V, $E_e$ = 0.50mW/cm$^2$[3] |
| | | OP505A | 4.30 | | | mA | $V_{CE}$ = 5V, $E_e$ = 0.50mW/cm$^2$[3] |
| $\Delta I_C/\Delta T$ | Relative $I_C$ Changes with Temperature | | | 1.00 | | %/°C | $V_{CE}$ = 5V, $E_e$ = 1.00mW/cm$^2$ $\lambda$ = 935nm |
| $I_{CEO}$ | Collector Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0[4] |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | | 0.40 | V | $I_C$ = 250µA, $E_e$ = 0.50mW/cm$^2$ $\lambda$ = 935nm[3] |

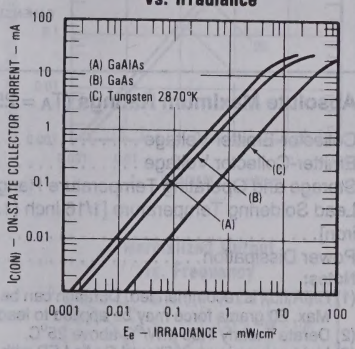
PHOTOSENSORS

## Typical Performance Curves

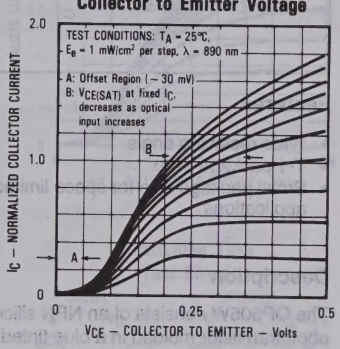
**Normalized Collector Current vs. Angular Displacement**



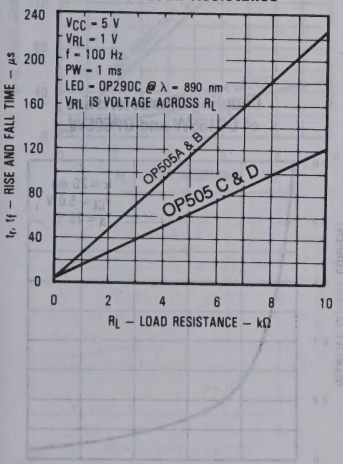

**On-State Collector Current vs. Irradiance**



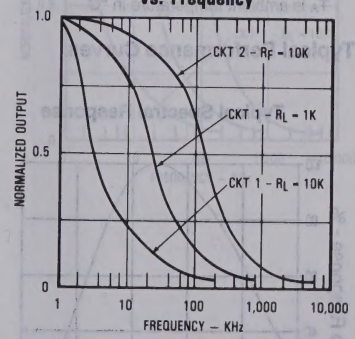

**Normalized Collector Current vs. Collector to Emitter Voltage**


IC – NORMALIZED COLLECTOR CURRENT
2.0
1.0
0
TEST CONDITIONS: TA = 25°C, Ee = 1 mW/cm2 per step, λ = 890 nm
A: Offset Region (~ 30 mV)
B: VCE(SAT) at fixed IC, decreases as optical input increases
B
A
0 0.25 0.5
VCE – COLLECTOR TO EMITTER – Volts

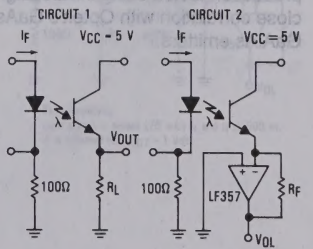
**Rise and Fall Time vs. Load Resistance**




**Normalized Output vs. Frequency**




**Switching Time Test Circuit**

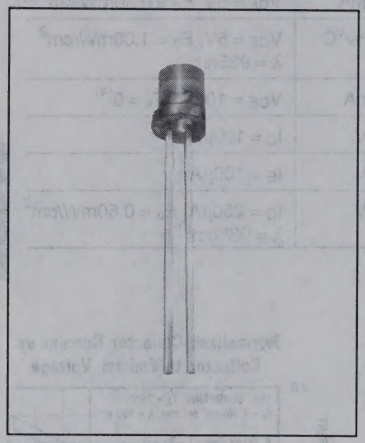


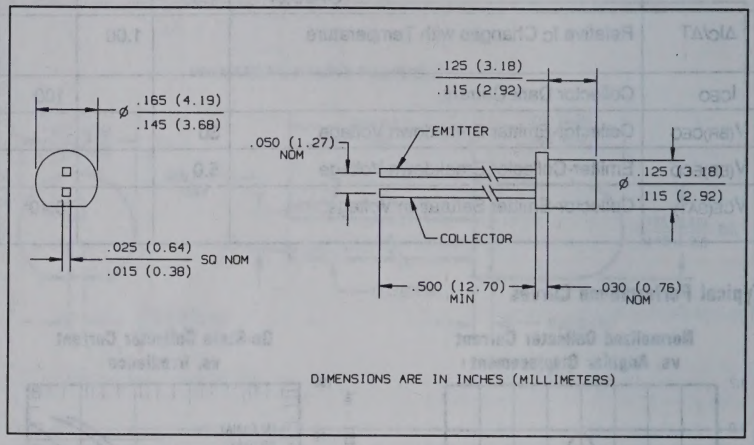

Test Conditions:
Light source is pulsed LED with $t_r$ and $t_f \leq$ 500 ns.
$I_F$ is adjusted for $V_{OUT}$ = 1 Volt.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# NPN Silicon Phototransistor
## Type OP505W






### Features

- Wide receiving angle
- T-1 package style
- Small package size for space limited applications

### Description

The OP505W consists of an NPN silicon phototransistor molded in a blue tinted plastic package. The wide receiving angle provides relatively even reception over a large area. This device is 100% production tested using infrared light for close correlation with Optek's GaAs and GaAlAs emitters.

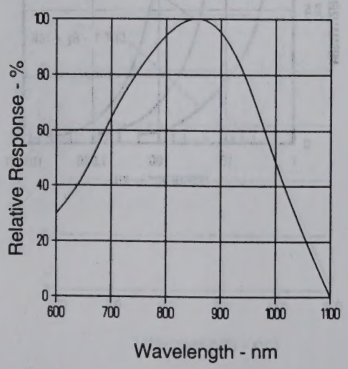
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

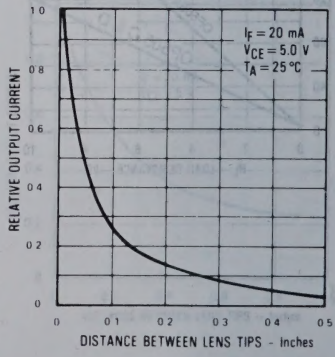
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire surface of the phototransistor being tested.
(4) To calculate typical collector dark current in μA, use the formula $I_{CED} = 10^{(0.04\,T_A - 3.4)}$ where $T_A$ is ambient temperature in °C.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP165W and OP505W**



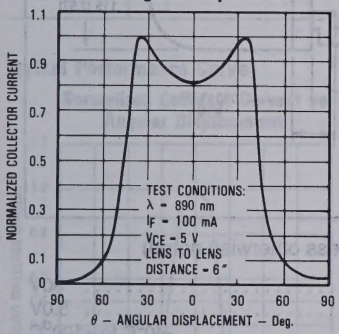
# Types OP505W

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

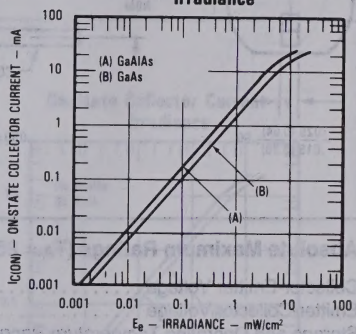
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $I_{C(ON)}$ | On-State Collector Current | 100.0 | | | µA | $V_{CE}$ = 5V, $E_e$ = 0.75mW/cm$^2$(3) |
| $I_{CEO}$ | Collector Dark Current | | | 100 | nA | $V_{CE}$ = 10.0V $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | | V | $I_E$ = 100µA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 0.40 | V | $I_C$ = 50µA, $E_e$ = .75mW/cm$^2$(3) |

## Typical Performance Curves

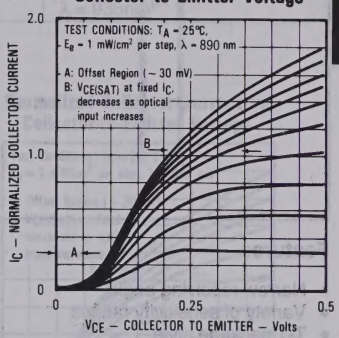
**Normalized Collector Current vs. Angular Displacement**



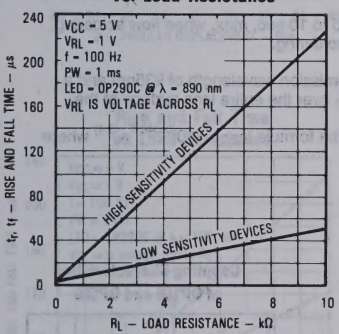

**On-State Collector Current vs Irradiance**



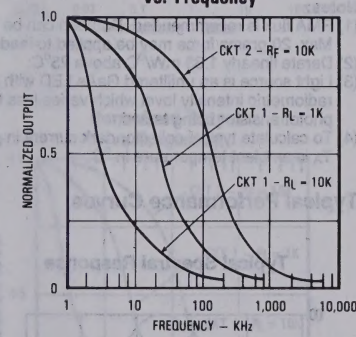

**Normalized Collector Current vs. Collector to Emitter Voltage**


IC – NORMALIZED COLLECTOR CURRENT
2.0
1.0
0
TEST CONDITIONS: TA = 25°C.
Ee = 1 mW/cm2 per step, λ = 890 nm
A: Offset Region (~ 30 mV)
B: VCE(SAT) at fixed IC decreases as optical input increases
B
A
0 0.25 0.5
VCE – COLLECTOR TO EMITTER – Volts

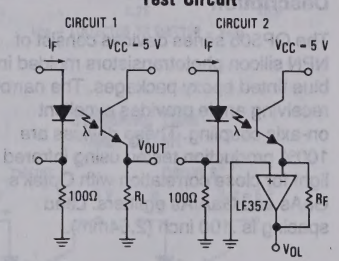
**Rise and Fall Time vs. Load Resistance**




**Normalized Output vs. Frequency**




**Switching Time Test Circuit**

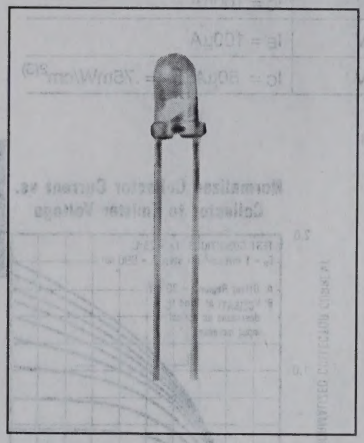


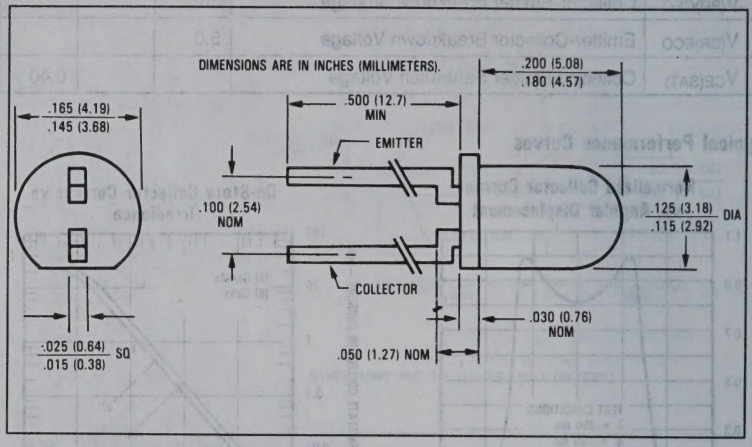

Test Conditions:
Light source is pulsed LED with $t_r$ and $t_f \leq$ 500 ns.
$I_F$ is adjusted for $V_{OUT}$ = 1 Volt.

PHOTOSENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# NPN Silicon Phototransistors
## Types OP506A, OP506B, OP506C, OP506D






### Features

- Narrow receiving angle
- Variety of sensitivity ranges
- T-1 package style
- Small package size for space limited applications

### Description

The OP506 series devices consist of NPN silicon phototransistors molded in blue tinted epoxy packages. The narrow receiving angle provides excellent on-axis coupling. These devices are 100% production tested using infrared light for close correlation with Optek's GaAs and GaAlAs emitters. Lead spacing is .100 inch (2.54mm).

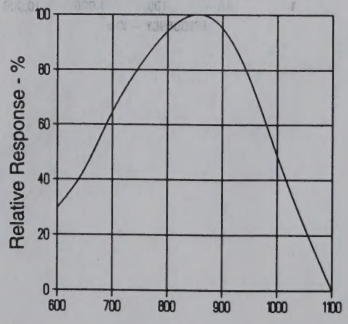
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

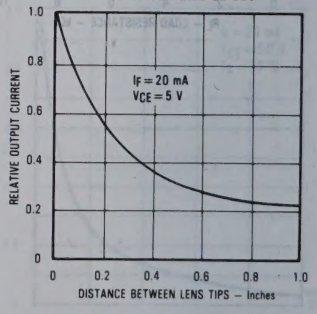
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) To calculate typical collector dark current in μA, use the formula $I_{CED} = 10^{(0.040\,T_A - 3.4)}$ where $T_A$ is ambient temperature in °C.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP166 and OP506**



# Types OP506A, OP506B, OP506C, OP506D

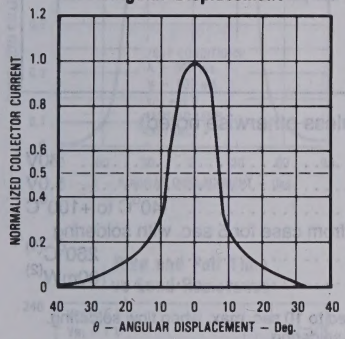
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$ | On-State Collector Current | OP506D | 0.55 | | | mA | $V_{CE}$ = 5V, $E_e$ = 0.50mW/cm$^2$[4] |
| | | OP506C | 1.10 | | 3.00 | mA | $V_{CE}$ = 5V, $E_e$ = 0.50mW/cm$^2$[4] |
| | | OP506B | 2.15 | | 5.95 | mA | $V_{CE}$ = 5V, $E_e$ = 0.50mW/cm$^2$[4] |
| | | OP506A | 4.30 | | | mA | $V_{CE}$ = 5V, $E_e$ = 0.50mW/cm$^2$[4] |
| $\Delta I_C/\Delta T$ | Relative $I_C$ Changes with Temperature | | | 1.00 | | %/°C | $V_{CE}$ = 5V, $E_e$ = 1.00mW/cm$^2$ $\lambda$ = 935nm |
| $I_{CEO}$ | Collector Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0[4] |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | | 0.40 | V | $I_C$ = 250µA, $E_e$ = 0.50mW/cm$^2$ $\lambda$ = 935nm[3] |

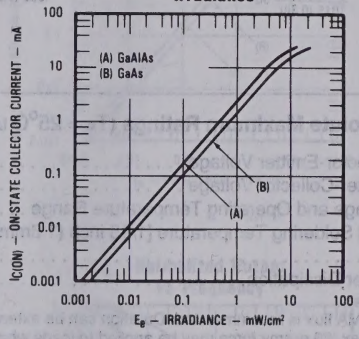
PHOTOSENSORS

## Typical Performance Curves

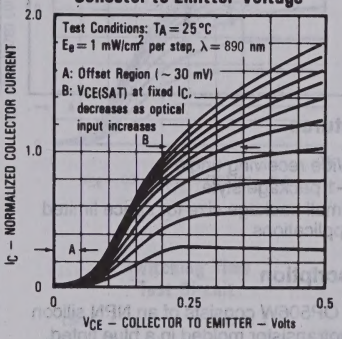
**Normalized Collector Current vs Angular Displacement**



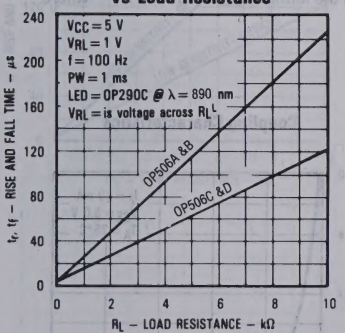

**On-State Collector Current vs Irradiance**



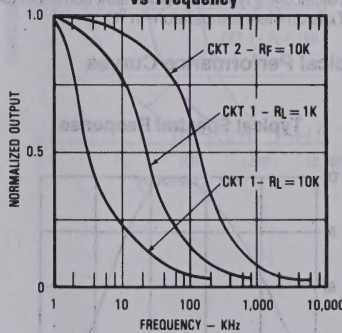

**Normalized Collector Current vs Collector-to-Emitter Voltage**


IC – NORMALIZED COLLECTOR CURRENT
2.0
1.0
0
Test Conditions: TA = 25°C
Ee = 1 mW/cm² per step, λ = 890 nm
A: Offset Region (~ 30 mV)
B: VCE(SAT) at fixed IC, decreases as optical input increases
B
A
0 0.25 0.5
VCE – COLLECTOR TO EMITTER – Volts

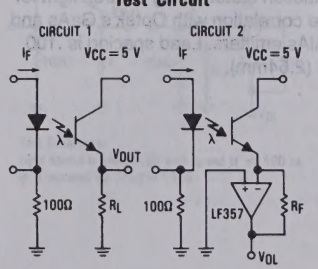
**Rise and Fall Time vs Load Resistance**




**Normalized Output vs Frequency**




**Switching Time Test Circuit**

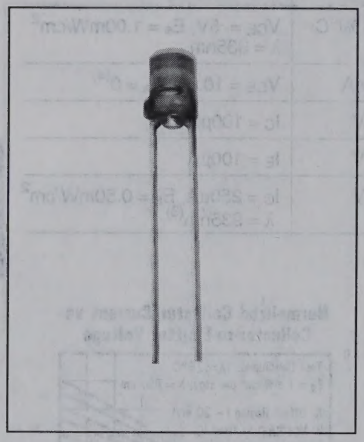


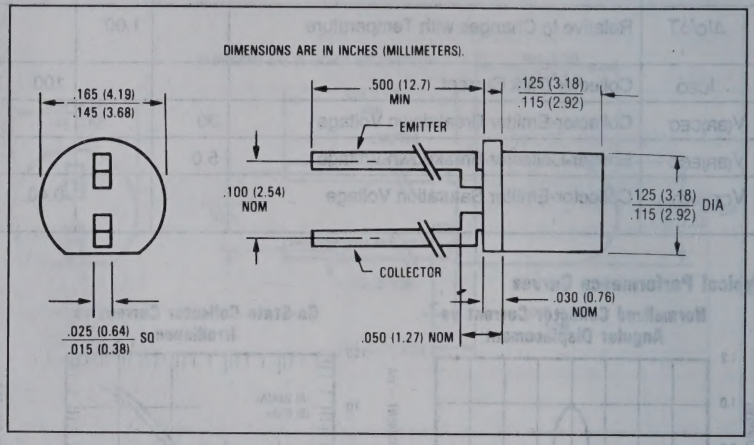

Test Conditions:
Light source is pulsed LED with $t_r$ and $t_f \leq$ 500 ns.
$I_F$ is adjusted for $V_{OUT}$ = 1 Volt.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# NPN Silicon Phototransistor
## Type OP506W






### Features

- Wide receiving angle
- T-1 package style
- Small package size for space limited applications

### Description

The OP506W consists of an NPN silicon phototransistor molded in a blue tinted plastic package. The wide receiving angle provides relatively even reception over a large area. This device is 100% production tested using infrared light for close correlation with Optek's GaAs and GaAlAs emitters. Lead spacing is .100 inch (2.54mm).

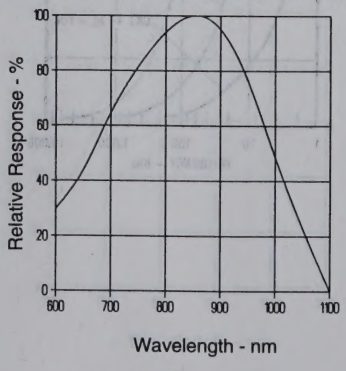
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

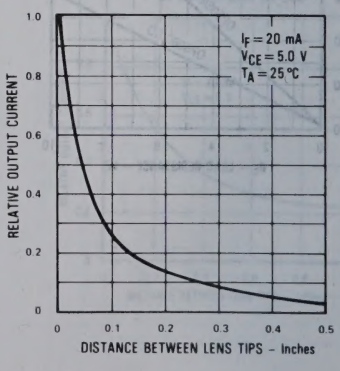
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) To calculate typical collector dark current in μA, use the formula $I_{CED} = 10^{(0.04\,T_A - 3.4)}$ where $T_A$ is ambient temperature in °C.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics**



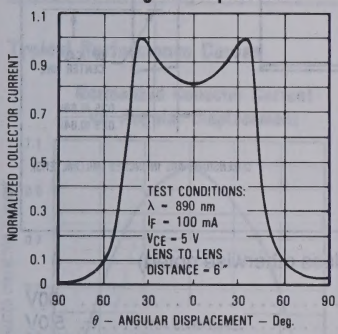
# Type OP506W

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

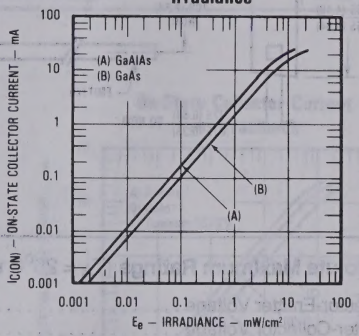
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $I_{C(ON)}$ | On-State Collector Current | 100 | | | μA | $V_{CE}$ = 5V, $E_e$ = 0.75mW/cm$^2$(3) |
| $I_{CEO}$ | Collector Dark Current | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | | V | $I_C$ = 100μA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | | V | $I_E$ = 100μA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 0.40 | V | $I_C$ = 50μA, $E_e$ = .75mW/cm$^2$(3) |

## Typical Performance Curves

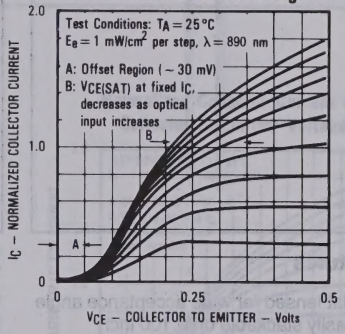
**Normalized Collector Current vs. Angular Displacement**



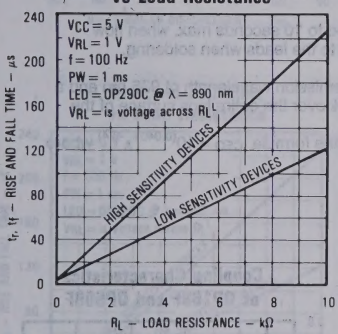

**On-State Collector Current vs Irradiance**



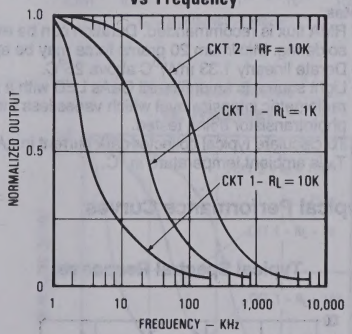

**Normalized Collector Current vs Collector-to-Emitter Voltage**


IC – NORMALIZED COLLECTOR CURRENT
2.0
1.0
0
Test Conditions: TA = 25°C
Ee = 1 mW/cm2 per step, λ = 890 nm
A: Offset Region (~ 30 mV)
B: VCE(SAT) at fixed IC, decreases as optical input increases
B
A
0 0.25 0.5
VCE – COLLECTOR TO EMITTER – Volts

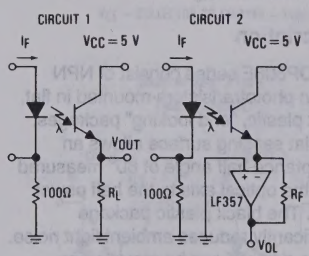
**Rise and Fall Time vs Load Resistance**




**Normalized Output vs Frequency**




**Switching Time Test Circuit**

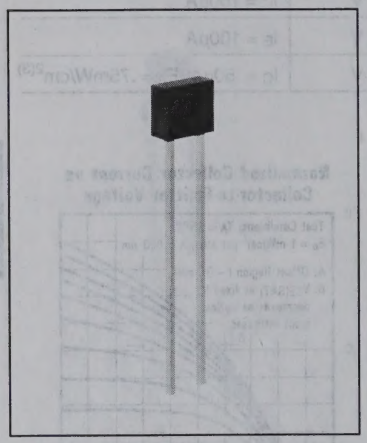


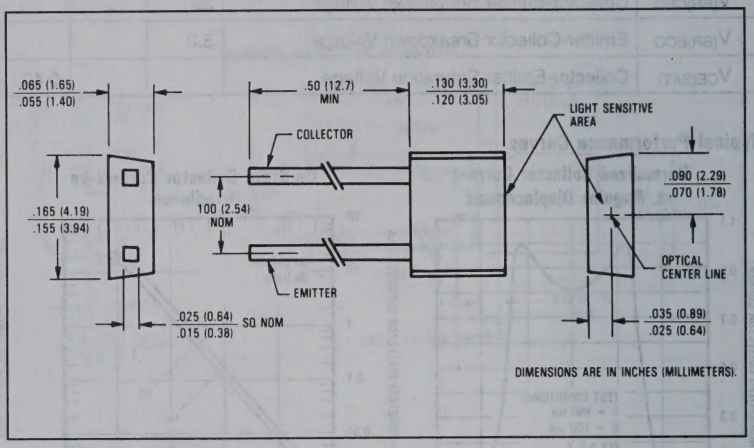

Test Conditions:
Light source is pulsed LED with $t_r$ and $t_f \leq$ 500 ns.
$I_F$ is adjusted for $V_{OUT}$ = 1 Volt.

PHOTOSENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# NPN Silicon Phototransistors
## Types OP508FA, OP508FB, OP508FC






### Features

- Flat lensed for wide acceptance angle
- Easily stackable on 0.100 inch (2.54mm) hole centers
- Low cost plastic package
- Mechanically and spectrally matched to the OP168F and OP268F series of infrared emitting diodes

### Description

The OP508F series consist of NPN silicon phototransistors mounted in flat, black plastic, "end looking" packages. The flat sensing surface allows an acceptance half angle of 60° measured from the optical axis to the half power point. The black plastic package significantly reduces ambient light noise. These devices can be mounted on 0.100" (2.54mm) hole centers, making them an ideal low cost alternate to hermetic pill discretes.

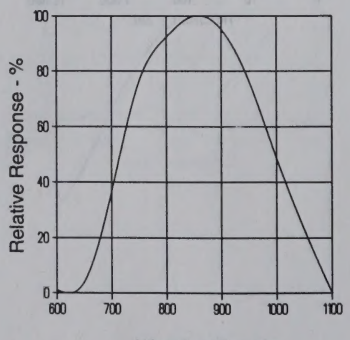
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

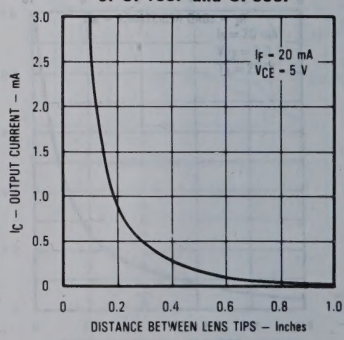
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering. Maximum 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935 nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) To calculate typical collector dark current in μA, use the formula $I_{CEO} = 10^{(0.040T_A - 3.4)}$ where $T_A$ is ambient temperature in °C.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP168F and OP508F**



# Types OP508FA, OP508FB, OP508FC

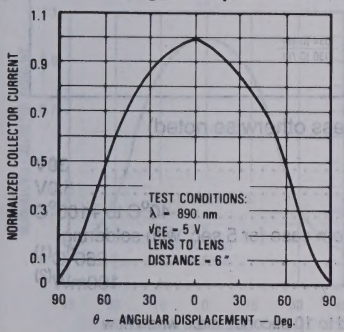
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$ | On-State Collector Current | OP508FC<br>OP508FB<br>OP508FA | 0.34<br>0.65<br>2.70 | | 5.10 | mA | $V_{CE}$ = 5.0V, $E_e$ = 5mW/cm$^2$(3) |
| $I_C/\Delta T$ | Relative $I_C$ Change with Temperature | | | 1.00 | | %/°C | $V_{CE}$ = 5.0V, $E_e$ = 1.0mW/cm$^2$(3) $\lambda$ = 890nm |
| $I_{CEO}$ | Collector-Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0(4) |
| $V_{(BR)CEO}$ | Collector-Emittor Breakdown Voltage | | 30 | | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | | 0.40 | V | $I_C$ = 100µA, $E_e$ = 5mW/cm$^2$(3) |

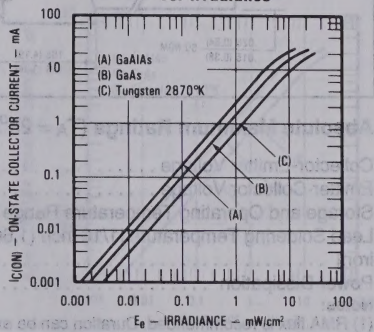
PHOTOSENSORS

## Typical Performance Curves

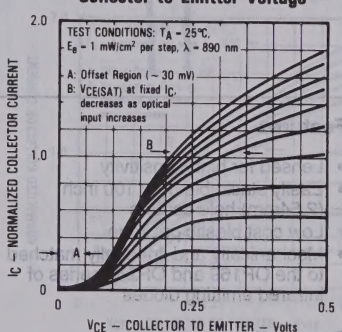
**Normalized Collector Current vs. Angular Displacement**



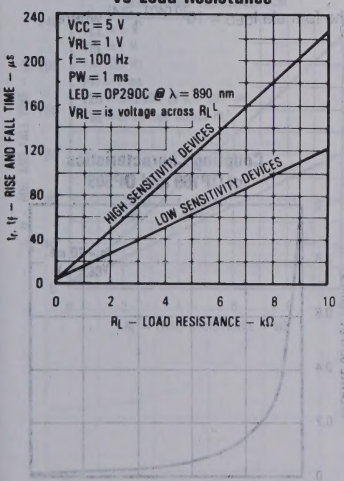

**On-State Collector Current vs. Irradiance**



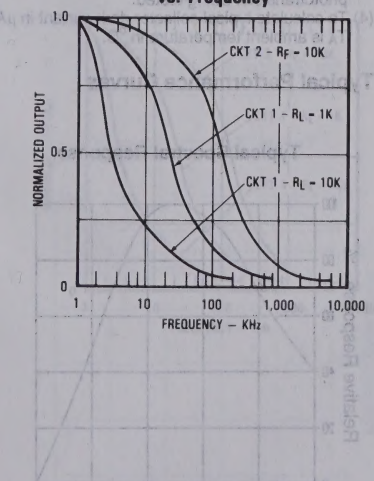

**Normalized Collector Current vs. Collector to Emitter Voltage**


IC – NORMALIZED COLLECTOR CURRENT
2.0
1.0
0
TEST CONDITIONS: TA = 25°C.
Ee = 1 mW/cm² per step, λ = 890 nm
A: Offset Region (~ 30 mV)
B: VCE(SAT) at fixed IC decreases as optical input increases
B
A
0 0.25 0.5
VCE – COLLECTOR TO EMITTER – Volts

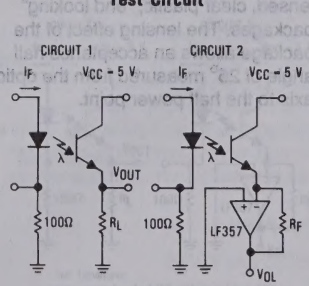
**Rise and Fall Time vs Load Resistance**




**Normalized Output vs. Frequency**



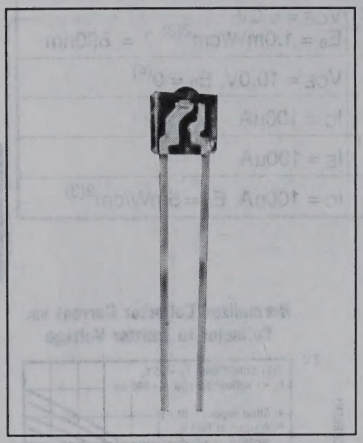

**Switching Time Test Circuit**

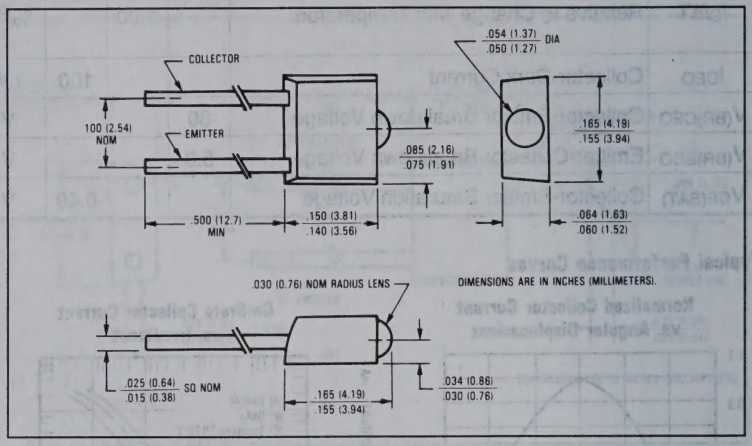



Test Conditions:
Light source is pulsed LED with $t_r$ and $t_f \leq$ 500 ns.
$I_F$ is adjusted for $V_{OUT}$ = 1 Volt.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# NPN Silicon Phototransistors
## Types OP509A, OP509B, OP509C






### Features

- Lensed for high sensitivity
- Easily stackable on 0.100 inch (2.54mm) hole centers
- Low cost plastic package
- Mechanically and spectrally matched to the OP169 and OP269 series of infrared emitting diodes

### Description

The OP509 series consist of NPN silicon phototransistors mounted in lensed, clear plastic, "end looking" packages. The lensing effect of the package allows an acceptance half angle of 25° measured from the optical axis to the half power point.

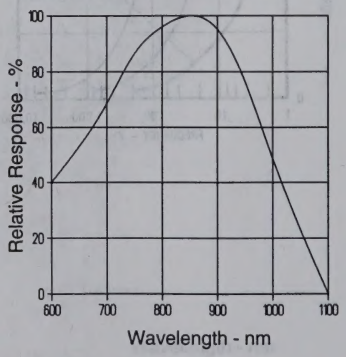
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

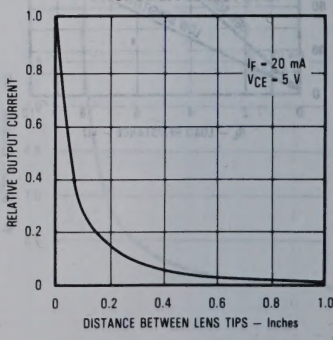
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering. Maximum 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935 nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) To calculate typical collector dark current in μA, use the formula $I_{CEO} = 10^{(0.040T_A - 3.4)}$ where $T_A$ is ambient temperature in °C.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP169 and OP509**



# Types OP509A, OP509B, OP509C

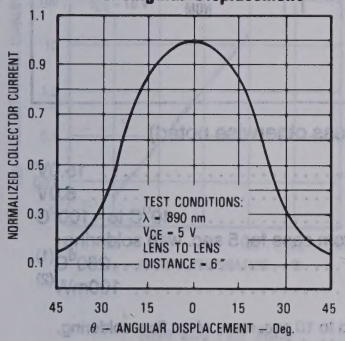
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$ | On-State Collector Current | OP509C<br>OP509B<br>OP509A | 0.7<br>1.4<br>5.7 | | 10.6 | mA | $V_{CE}$ = 5.0V, $E_e$ = 5mW/cm$^2$[3] |
| $I_C/\Delta T$ | Relative $I_C$ Change with Temperature | | | 1.00 | | %/°C | $V_{CE}$ = 5.0V, $E_e$ = 1.0mW/cm$^2$[3] $\lambda$ = 890nm |
| $I_{CEO}$ | Collector-Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0[4] |
| $V_{(BR)CEO}$ | Collector-Emittor Breakdown Voltage | | 30 | | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | | 0.40 | V | $I_C$ = 250µA, $E_e$ = 5mW/cm$^2$[3] |

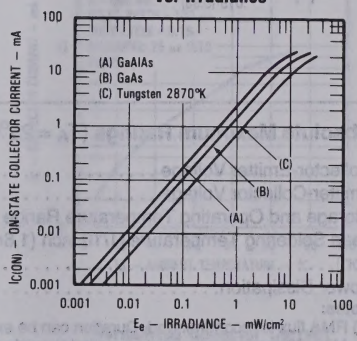
PHOTOSENSORS

## Typical Performance Curves

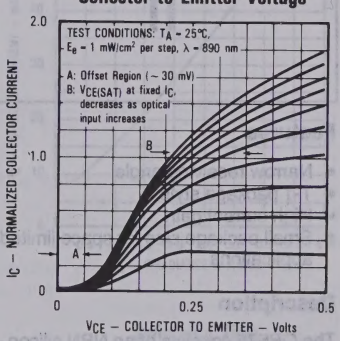
**Normalized Collector Current vs. Angular Displacement**



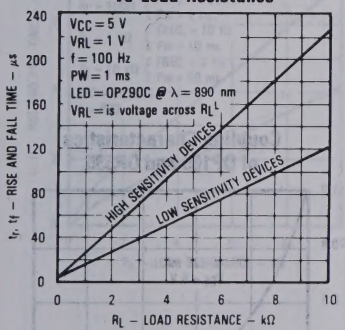

**On-State Collector Current vs. Irradiance**



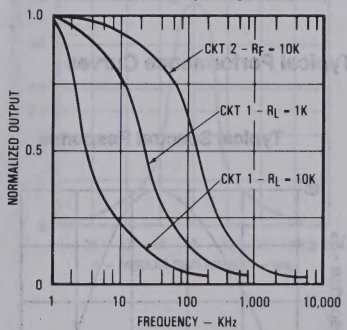

**Normalized Collector Current vs. Collector to Emitter Voltage**


IC – NORMALIZED COLLECTOR CURRENT
2.0
1.0
0
TEST CONDITIONS: TA = 25°C,
Ee = 1 mW/cm2 per step, λ = 890 nm
A: Offset Region (~ 30 mV)
B: VCE(SAT) at fixed IC, decreases as optical input increases
B
A
0 0.25 0.5
VCE – COLLECTOR TO EMITTER – Volts

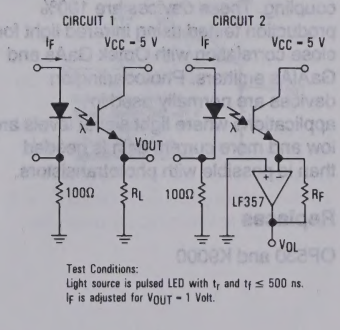
**Rise and Fall Time vs Load Resistance**




**Normalized Output vs. Frequency**



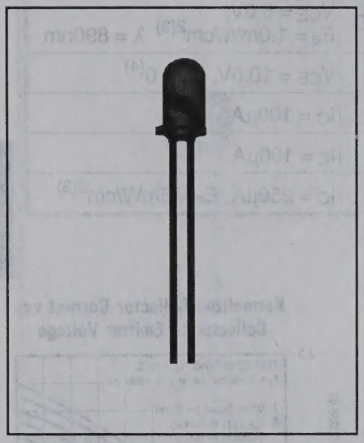

**Switching Time Test Circuit**

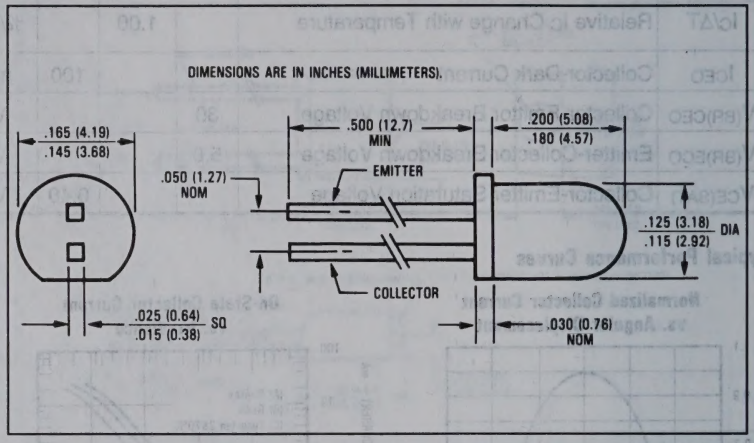



Test Conditions:
Light source is pulsed LED with $t_r$ and $t_f \leq$ 500 ns.
$I_F$ is adjusted for $V_{OUT}$ = 1 Volt.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# NPN Silicon Photodarlington
## Type OP535A, OP535B, OP535C






### Features

- Narrow receiving angle
- T-1 package style
- High current gain
- Small package size for space limited applications

### Description

The OP535 consists of an NPN silicon photodarlington molded in a green plastic package. The narrow receiving angle provides excellent on-axis coupling. These devices are 100% production tested using infrared light for close correlation with Optek GaAs and GaAlAs emitters. Photodarlington devices are normally used in applications where light signal levels are low and more current gain is needed than is possible with phototransistors.

### Replaces

OP530 and K9000

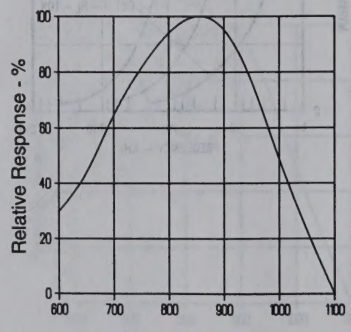
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 15.0V |
| Emitter-Collector Voltage | 5.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

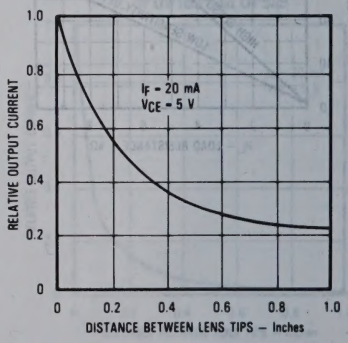
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP165 and OP535**



# Types OP535A, OP535B, OP535C

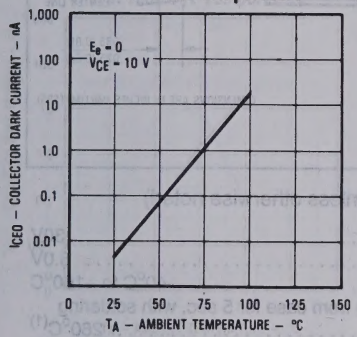
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$[3] | On-State Collector Current | OP535C<br>OP535B<br>OP535A | 1.5<br>3.5<br>10.5 | | 32.0 | mA | $V_{CE}$ = 5.0 V,<br>$E_e$ = 0.13 mW/cm$^2$ |
| $I_{CEO}$ | Collector Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0 V, $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 15.0 | | | V | $I_C$ = 1.0 mA, $E_e$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100 μA, $E_e$ = 0 |
| $V_{CE(SAT)}$[3] | Collector-Emitter Saturation Voltage | | | | 1.10 | V | $I_C$ = 0.4 mA, $E_e$ = 0.13 mW/cm$^2$ |

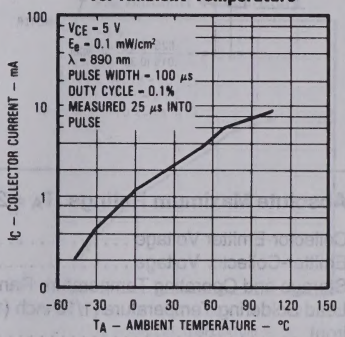


## Typical Performance Curves

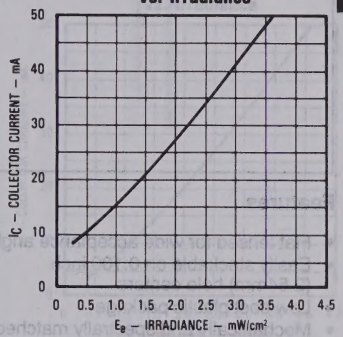
**Collector Dark Current vs. Ambient Temperature**



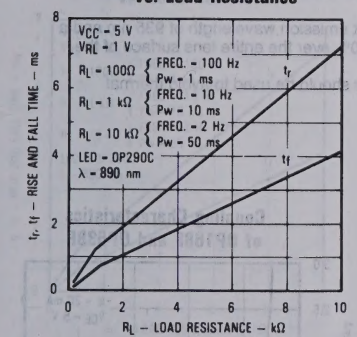

**Collector Current vs. Ambient Temperature**



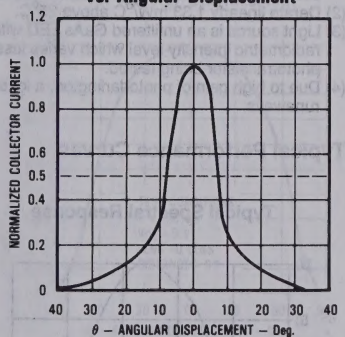

**Collector Current vs. Irradiance**



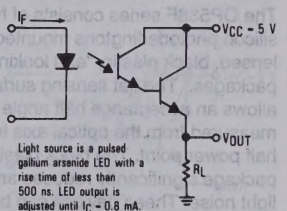

**Rise and Fall Time vs. Load Resistance**




**Normalized Collector Current vs. Angular Displacement**

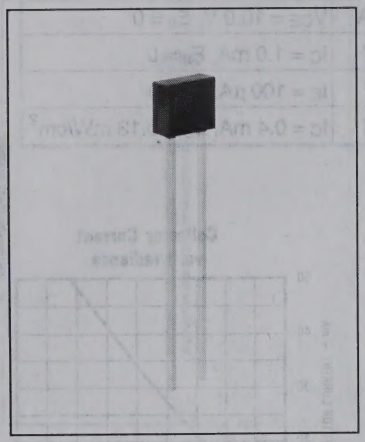


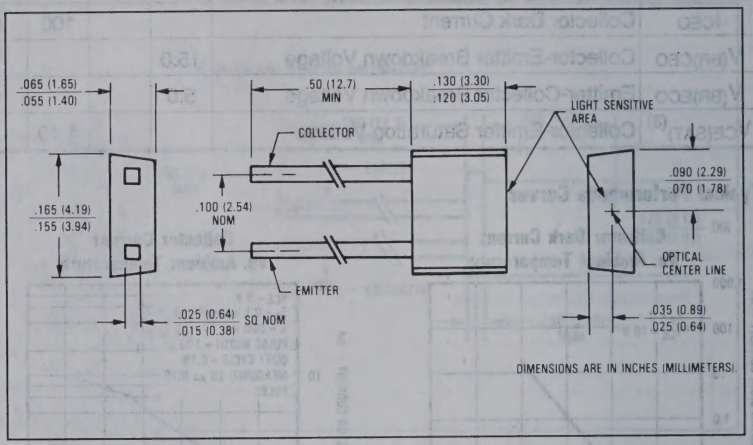

**Switching Time Test Circuit**


$I_F$
$V_{CC}$ = 5 V
$V_{OUT}$
$R_L$
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until $I_C$ = 0.8 mA.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# NPN Silicon Photodarlingtons
## Types OP538FA, OP538FB, OP538FC






### Features

- Flat lensed for wide acceptance angle
- Easily stackable on 0.100 inch (2.54mm) hole centers
- Low cost plastic package
- Mechanically and spectrally matched to the OP168F and OP268F series of infrared emitting diodes

### Description

The OP538F series consists of NPN silicon photodarlingtons mounted in flat lensed, black plastic, "end looking" packages. The flat sensing surface allows an acceptance half angle of 65° measured from the optical axis to the half power point. The black plastic package significantly reduces ambient light noise. These devices can be mounted on 0.100" (2.54mm) hole centers making them an ideal low cost alternative to hermetic pill discretes.

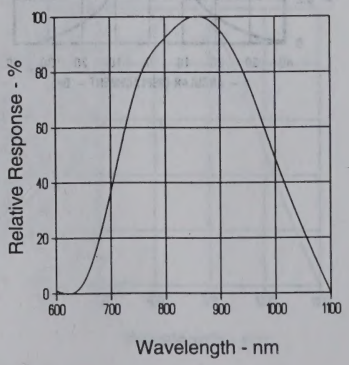
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

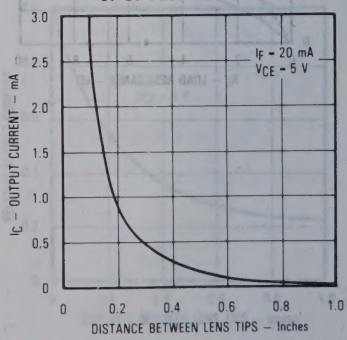
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering. Maximum 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935 nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) Due to high gain of photodarlington, a load resistor should be used to avoid thermal runaways.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP168F and OP538F**



# Types OP538FA, OP538FB, OP538FC

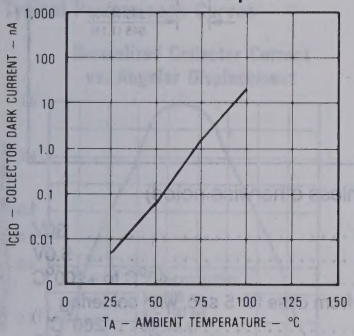
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$[4] | On-State Collector Current | OP538FC<br>OP538FB<br>OP538FA | 1.1<br>2.3<br>6.8 | | 20.5 | mA | $V_{CE}$ = 5.0V, $E_e$ = 0.5mW/cm$^2$[3] |
| $I_{CEO}$ | Collector-Dark Current | | | | 225 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emittor Breakdown Voltage | | 15.0 | | | V | $I_C$ = 1.00mA, $E_e$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100μA, $E_e$ = 0 |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | | 1.00 | V | $I_C$ = 0.5mA, $E_e$ = 0.5mW/cm$^2$[3] |

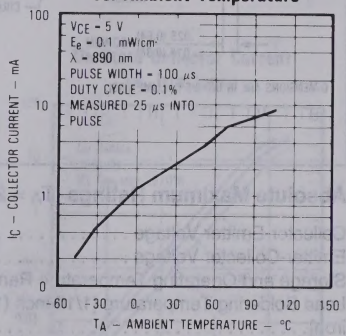
PHOTOSENSORS

## Typical Performance Curves

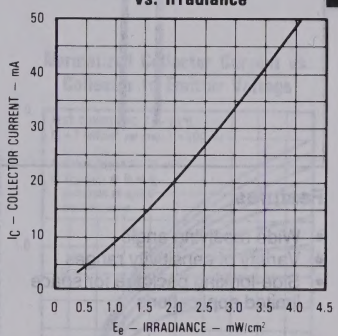
**Collector Dark Current vs. Ambient Temperature**



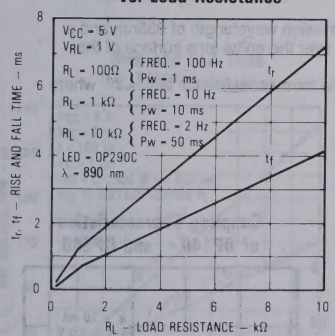

**Collector Current vs. Ambient Temperature**



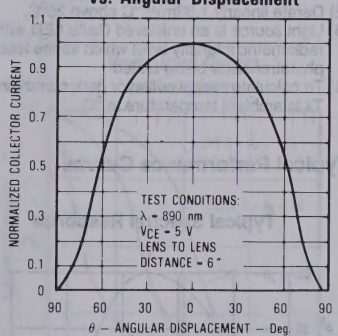

**Collector Current vs. Irradiance**



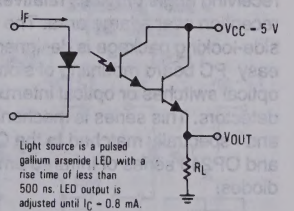

**Rise and Fall Time vs. Load Resistance**


VCC = 5 V
VRL = 1 V
RL = 100Ω { FREQ. = 100 Hz, Pw = 1 ms
RL = 1 kΩ { FREQ. = 10 Hz, Pw = 10 ms
RL = 10 kΩ { FREQ. = 2 Hz, Pw = 50 ms
LED = OP290C
λ = 890 nm
tr
tf
tr, tf – RISE AND FALL TIME – ms
8
6
4
2
0
0 2 4 6 8 10
RL – LOAD RESISTANCE – kΩ

**Normalized Collector Current vs. Angular Displacement**



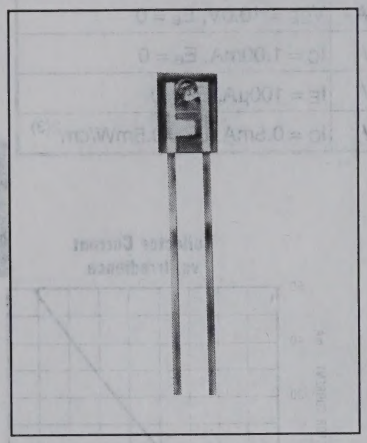

**Switching Time Test Circuit**

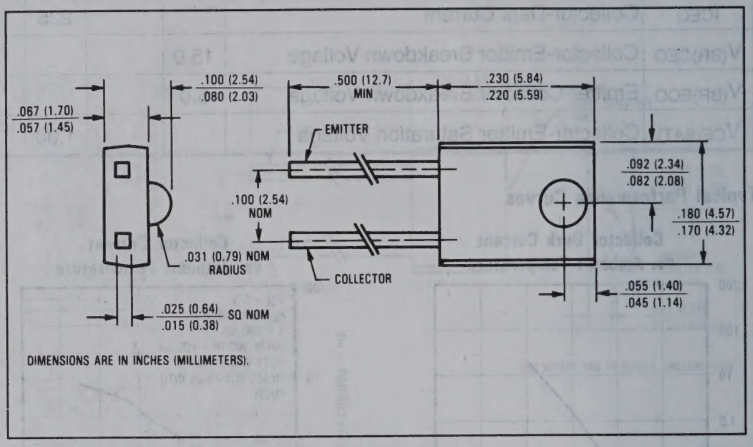

IF
VCC = 5 V
VOUT
RL
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until IC = 0.8 mA.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# NPN Silicon Phototransistors
## Types OP550A, OP550B, OP550C, OP550D






### Features

- Wide receiving angle
- Variety of sensitivity ranges
- Side-looking package for space limited applications

### Description

The OP550 series devices consist of NPN silicon phototransistors molded in clear epoxy packages. The wide receiving angle provides relatively even reception over a large area. The side-looking package is designed for easy PC board mounting of slotted optical switches or optical interrupt detectors. This series is mechanically and spectrally matched to the OP140 and OP240 series of infrared emitting diodes.

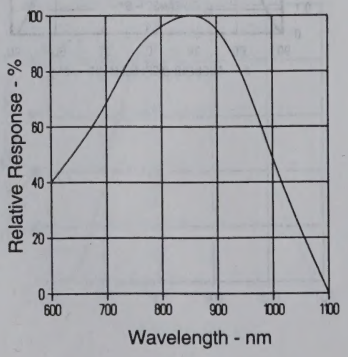
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Storage and Operating Temperature Range ..... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 260°C(1)
Power Dissipation ..... 100mW(2)

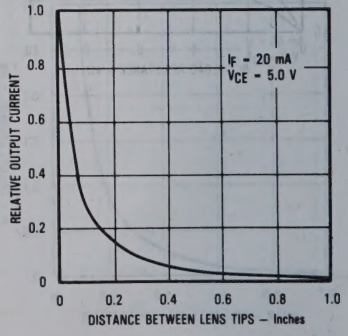
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) To calculate typical collector dark current in μA, use the formula $I_{CED} = 10^{(0.040\,T_A - 3.4)}$ where $T_A$ is ambient temperature in °C.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP140 and OP550**



# Types OP550A, OP550B, OP550C, OP550D

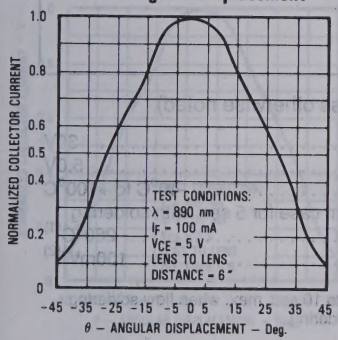
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$ | On-State Collector Current | OP550D | 0.25 | | | mA | $V_{CE}$ = 5.0V, $E_e$ = 1.0mW/cm$^2$[3] |
| | | OP550C | 0.25 | | 2.40 | mA | |
| | | OP550B | 1.30 | | 4.70 | mA | |
| | | OP550A | 2.55 | | | mA | |
| $\Delta I_C/\Delta T$ | Relative $I_C$ Changes with Temperature | | | 1.00 | | %/°C | $V_{CE}$ = 5.0V, $E_e$ = 1.00mW/cm$^2$ $\lambda$ = 935nm |
| $I_{CEO}$ | Collector Dark Current | | | 100 | | nA | $V_{CE}$ = 10.0V, $E_e$ = 0[4] |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 0.40 | | V | $I_C$ = 100µA, $E_e$ = 1.0mW/cm$^2$[3] |

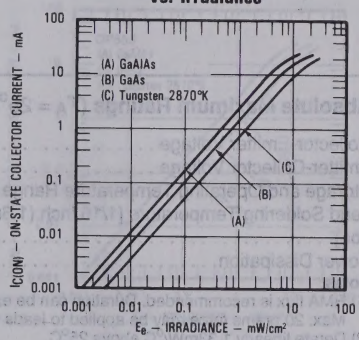
PHOTOSENSORS

## Typical Performance Curves

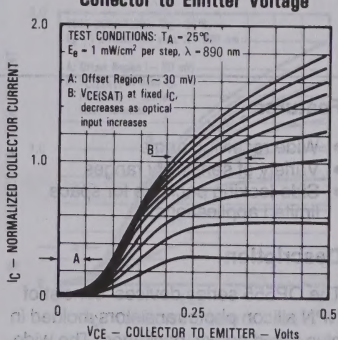
**Normalized Collector Current vs. Angular Displacement**



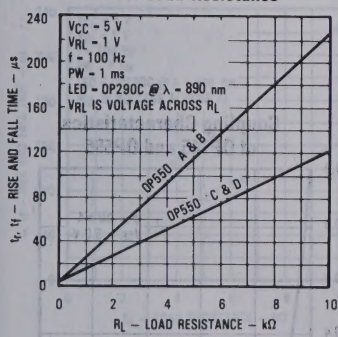

**On-State Collector Current vs. Irradiance**



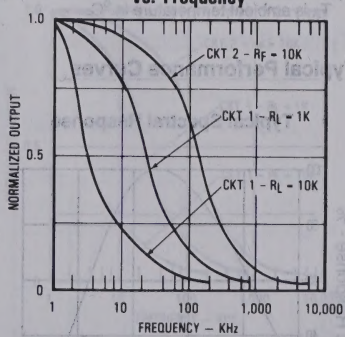

**Normalized Collector Current vs. Collector to Emitter Voltage**


IC – NORMALIZED COLLECTOR CURRENT
2.0
1.0
0
TEST CONDITIONS: TA = 25°C,
Ee = 1 mW/cm² per step, λ = 890 nm
A: Offset Region (~ 30 mV)
B: VCE(SAT) at fixed IC, decreases as optical input increases
B
A
0 0.25 0.5
VCE – COLLECTOR TO EMITTER – Volts

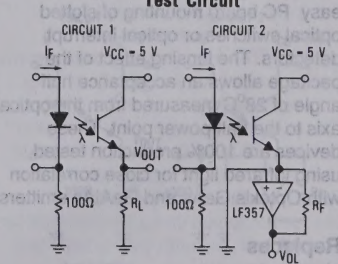
**Rise and Fall Time vs. Load Resistance**




**Normalized Output vs. Frequency**




**Switching Time Test Circuit**

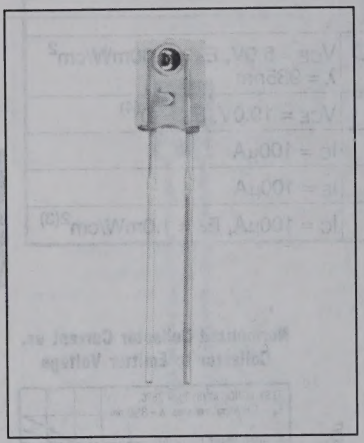


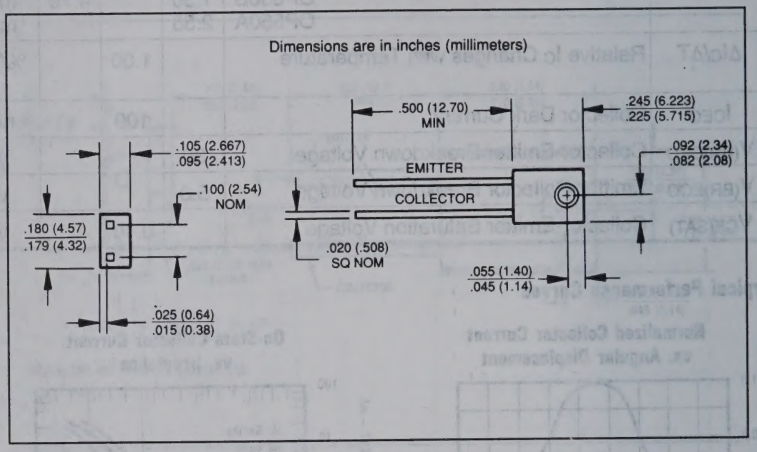

Test Conditions:
Light source is pulsed LED with $t_r$ and $t_f \leq$ 500 ns.
$I_F$ is adjusted for $V_{OUT}$ = 1 Volt.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# NPN Silicon Phototransistors
## Types OP555A, OP555B, OP555C, OP555D






### Features

- Wide receiving angle
- Variety of sensitivity ranges
- Side-looking package for space limited applications

### Description

The OP555 series devices consist of NPN silicon phototransistors molded in blue tinted epoxy packages. The wide receiving angle provides relatively even reception over a large area. The side-looking package is designed for easy PC board mounting of slotted optical switches or optical interrupt detectors. The lensing effect of the package allows an acceptance half angle of 28°C measured from the optical axis to the half power point. These devices are 100% production tested using infrared light for close correlation with Optek's GaAs and GaAlAs emitters.

### Replaces

K5550

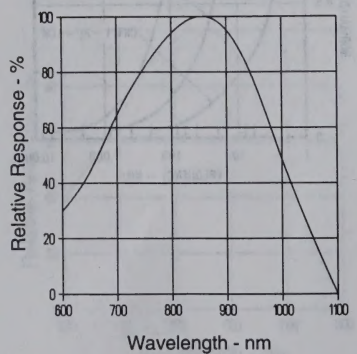
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

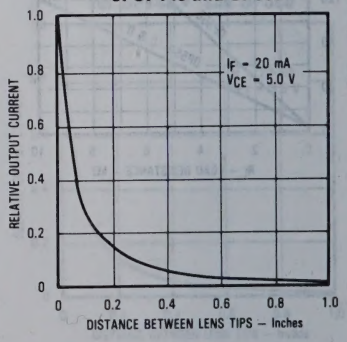
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) To calculate typical collector dark current in μA, use the formula $I_{CED} = 10^{(0.040\ T_A - 3.4)}$ where $T_A$ is ambient temperature in °C.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP145 and OP555**



# Types OP555A, OP555B, OP555C, OP555D

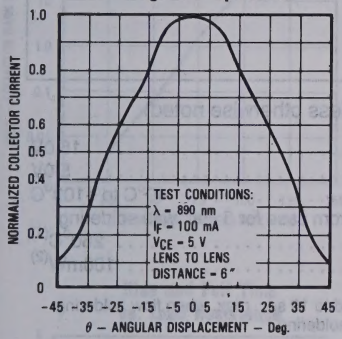
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$ | On-State Collector Current | OP555D | 0.25 | | | mA | $V_{CE}$ = 5.0V, $E_e$ = 1.0mW/cm$^2$ (3) |
| | | OP555C | 0.25 | | 2.40 | mA | |
| | | OP555B | 1.30 | | 4.70 | mA | |
| | | OP555A | 2.55 | | | mA | |
| $\Delta I_C/\Delta T$ | Relative $I_C$ Changes with Temperature | | | 1.00 | | %/°C | $V_{CE}$ = 5.0V, $E_e$ = 1.0mW/cm$^2$ $\lambda$ = 935nm |
| $I_{CEO}$ | Collector Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0 (4) |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | | 0.40 | V | $I_C$ = 100µA, $E_e$ = 1.0mW/cm$^2$ (3) |

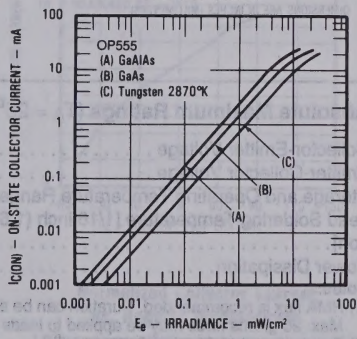
PHOTOSENSORS

## Typical Performance Curves

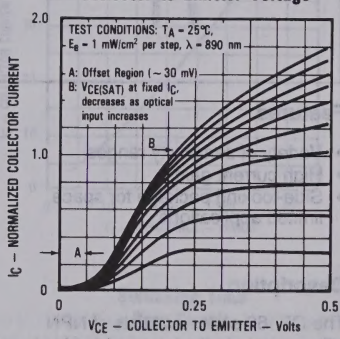
**Normalized Collector Current vs. Angular Displacement**



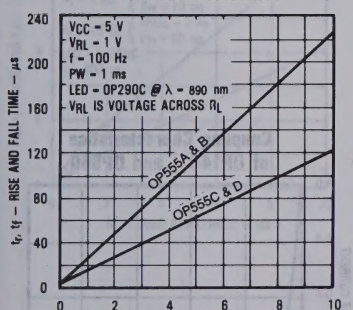

**On-State Collector Current vs. Irradiance**



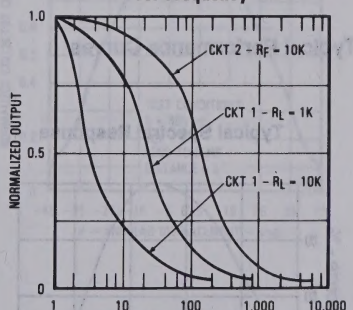

**Normalized Collector Current vs. Collector to Emitter Voltage**


IC – NORMALIZED COLLECTOR CURRENT
2.0
1.0
0
TEST CONDITIONS: TA = 25°C,
Ee = 1 mW/cm² per step, λ = 890 nm
A: Offset Region (~ 30 mV)
B: VCE(SAT) at fixed IC, decreases as optical input increases
B
A
0 0.25 0.5
VCE – COLLECTOR TO EMITTER – Volts

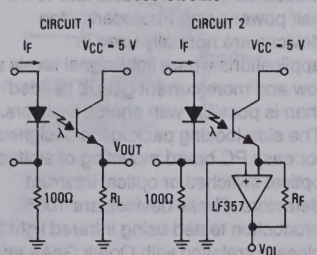
**Rise and Fall Time vs. Load Resistance**




**Normalized Output vs. Frequency**




**Switching Time Test Circuit**

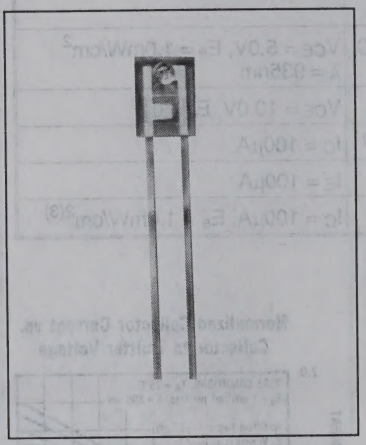


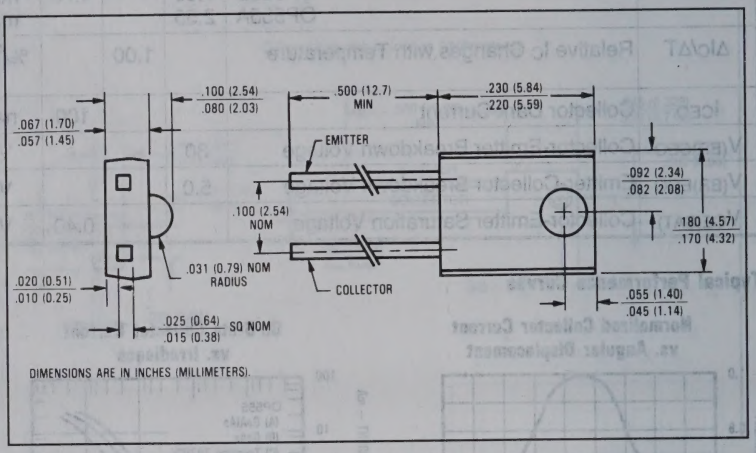

Test Conditions:
Light source is pulsed LED with $t_r$ and $t_f \leq$ 500 ns.
$I_F$ is adjusted for $V_{OUT}$ = 1 Volt.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# NPN Silicon Photodarlington
## Types OP560A, OP560B, OP560C






### Features

- Variety of sensitivity ranges
- High current gain
- Side-looking package for space limited applications

### Description

The OP560 series consists of NPN silicon photodarlingtons molded in clear epoxy packages. The lensing effect allows an acceptance half angle of 28° measured from the optical axis to the half power point. Photodarlington devices are normally used in applications where light signal levels are low and more current gain is needed than is possible with phototransistors. The side-looking package is designed for easy PC board mounting of slotted optical switches or optical interrupt detectors. These devices are 100% production tested using infrared light for close correlation with Optek GaAs and GaAlAs emitters.

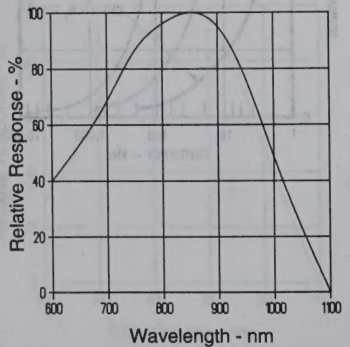
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 15.0V |
| Emitter-Collector Voltage | 5.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

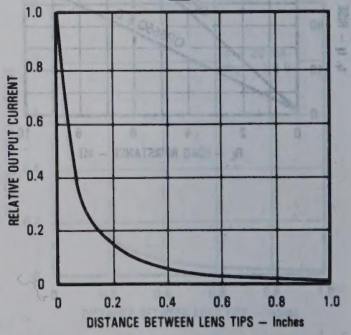
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP140__ and OP560**



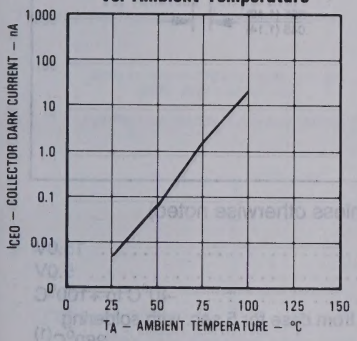
# Types OP560A, OP560B, OP560C

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

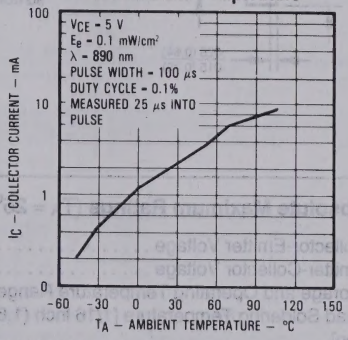
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$ | On-State Collector Current | OP560C | 1.1 | | | mA | $V_{CE}$ = 2V, $E_e$ = .1mW/cm$^2$(3) |
| | | OP560B | 3.3 | | 9.8 | mA | $V_{CE}$ = 2V, $E_e$ = .1mW/cm$^2$(3) |
| | | OP560A | 6.6 | | | mA | $V_{CE}$ = 2V, $E_e$ = .1mW/cm$^2$(3) |
| $I_{CEO}$ | Collector Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 15.0 | | | V | $I_C$ = 1.00mA, $E_e$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA, $E_e$ = 0 |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | | 1.10 | V | $I_C$ = .4mA, $E_e$ = .10mW/cm$^2$(3) |

## Typical Performance Curves

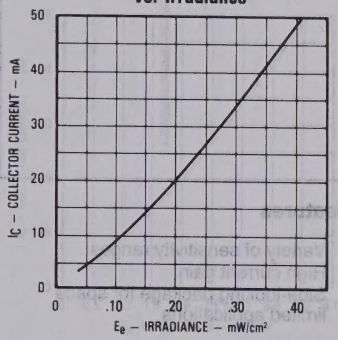
**Collector Dark Current vs. Ambient Temperature**



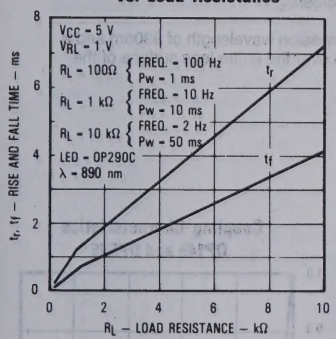

**Collector Current vs. Ambient Temperature**



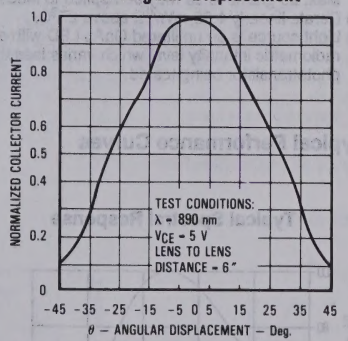

**Collector Current vs. Irradiance**



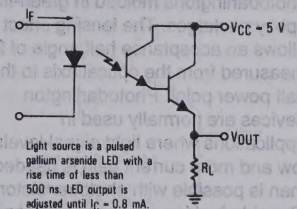

**Rise and Fall Time vs. Load Resistance**


VCC = 5 V
VRL = 1 V
RL = 100Ω { FREQ. = 100 Hz Pw = 1 ms
RL = 1 kΩ { FREQ. = 10 Hz Pw = 10 ms
RL = 10 kΩ { FREQ. = 2 Hz Pw = 50 ms
LED = OP290C
λ = 890 nm
tr
tf
tr, tf – RISE AND FALL TIME – ms
8
6
4
2
0
0 2 4 6 8 10
RL – LOAD RESISTANCE – kΩ

**Normalized Collector Current vs. Angular Displacement**

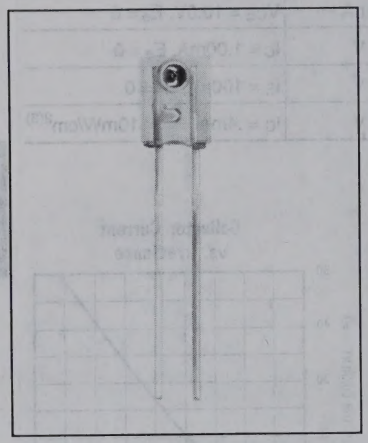


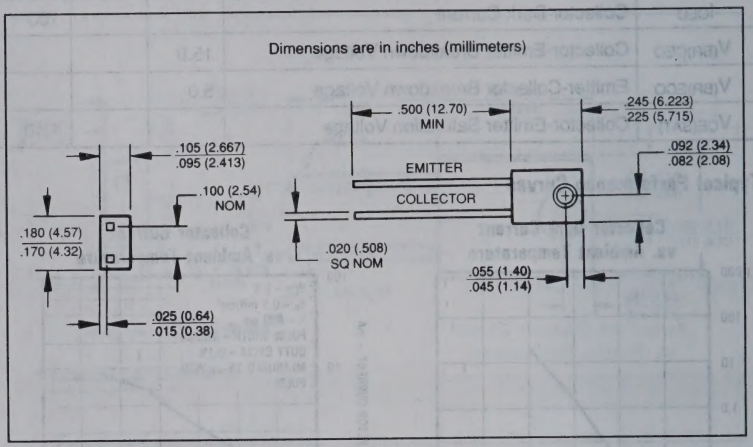

**Switching Time Test Circuit**


IF
VCC = 5 V
VOUT
RL
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until IC = 0.8 mA.

PHOTOSENSORS

# NPN Silicon Photodarlington
## Types OP565A, OP565B, OP565C






### Features

- Variety of sensitivity ranges
- High current gain
- Side-looking package for space limited applications

### Description

The OP565 series consist of NPN silicon photodarlingtons molded in green-tinted epoxy packages. The lensing effect allows an acceptance half angle of 28° measured from the optical axis to the half power point. Photodarlington devices are normally used in applications where light signal levels are low and more current gain is needed than is possible with phototransistors. The side-looking package is designed for easy PC board mounting of slotted optical switches or optical interrupt detectors. These devices are 100% production tested using infrared light for close correlation with Optek GaAs and GaAlAs emitters.

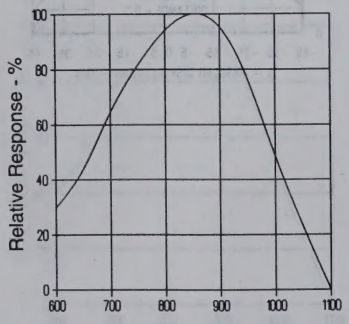
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 15.0V |
| Emitter-Collector Voltage | 5.0V |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 100mW(2) |

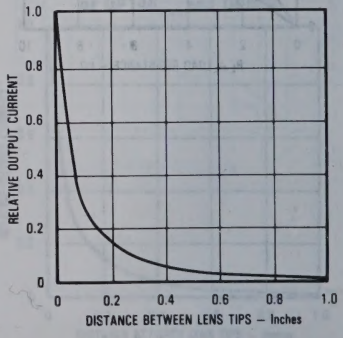
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 930nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics OP145 and OP565**



# Types OP565A, OP565B, OP565C

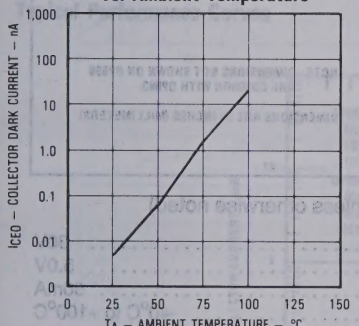
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$ | On-State Collector Current | OP565C | 1.1 | | | mA | $V_{CE}$ = 2V, $E_e$ = .10mW/cm$^2$[3] |
| | | OP565B | 3.3 | | 9.8 | mA | $V_{CE}$ = 2V, $E_e$ = .10mW/cm$^2$[3] |
| | | OP565A | 6.6 | | | mA | $V_{CE}$ = 2V, $E_e$ = .10mW/cm$^2$[3] |
| $I_{CEO}$ | Collector Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 15.0 | | | V | $I_C$ = 1.00mA, $E_e$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100μA, $E_e$ = 0 |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | | 1.1 | V | $I_C$ = .40mA, $E_e$ = .10mW/cm$^2$[3] |

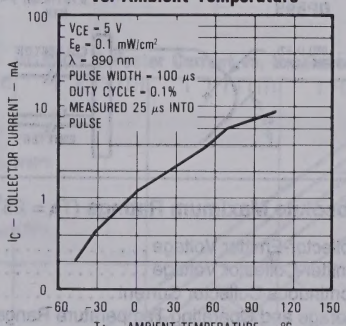
PHOTOSENSORS

## Typical Performance Curves

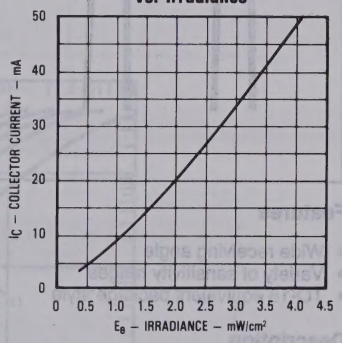
**Collector Dark Current vs. Ambient Temperature**



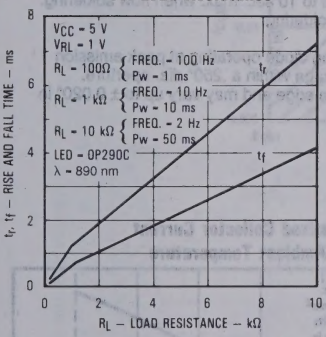

**Collector Current vs. Ambient Temperature**



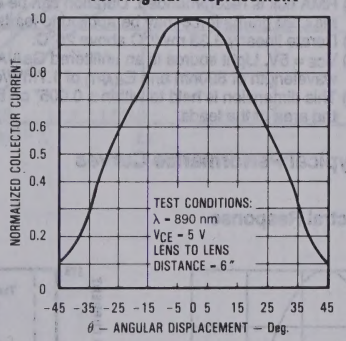

**Collector Current vs. Irradiance**



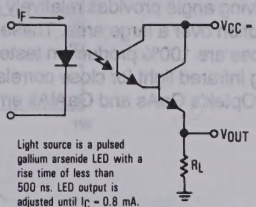

**Rise and Fall Time vs. Load Resistance**


VCC = 5 V
VRL = 1 V
RL = 100Ω { FREQ. = 100 Hz, Pw = 1 ms
RL = 1 kΩ { FREQ. = 10 Hz, Pw = 10 ms
RL = 10 kΩ { FREQ. = 2 Hz, Pw = 50 ms
LED = OP290C
λ = 890 nm
tr
tf
8
6
4
2
0
tr, tf – RISE AND FALL TIME – ms
0 2 4 6 8 10
RL – LOAD RESISTANCE – kΩ

**Normalized Collector Current vs. Angular Displacement**

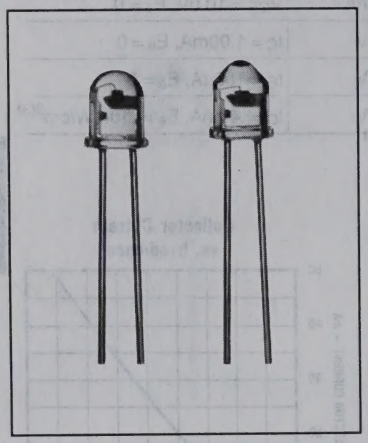


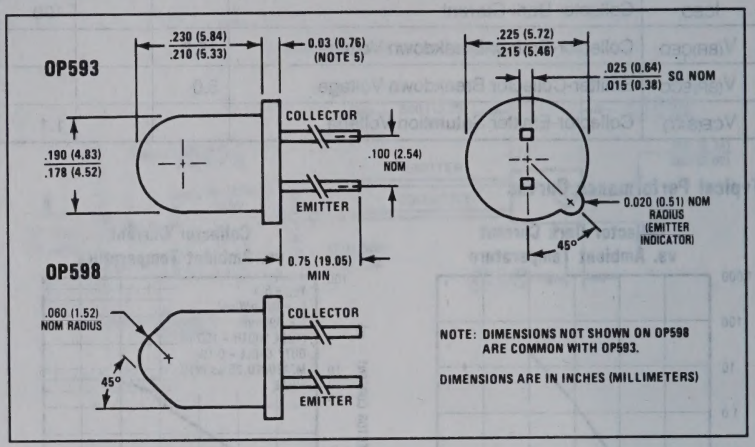

**Switching Time Test Circuit**


IF
VCC = 5 V
VOUT
RL
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until IC = 0.8 mA.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# NPN Plastic Silicon Phototransistors
## Types OP593, OP598 Series






### Features

- Wide receiving angle
- Variety of sensitivity ranges
- TO-18 equivalent package style

### Description

The OP593/598 series consist of NPN silicon phototransistors molded in dark blue epoxy packages. The wide receiving angle provides relatively even reception over a large area. These devices are 100% production tested using infrared light for close correlation with Optek's GaAs and GaAlAs emitters.

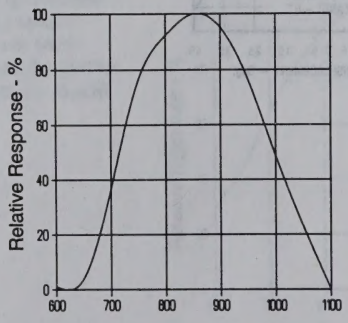
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Continuous Collector Current | 50mA |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 250mW(2) |

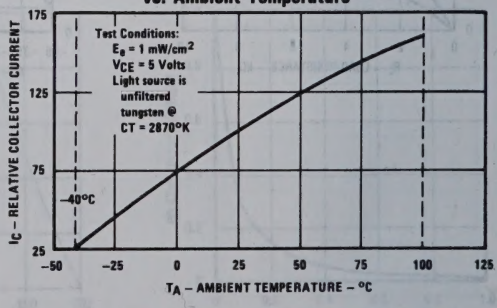
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 3.33 mW/°C above 25°C.
(3) $V_{CE}$ = 5V. Light source is an unfiltered GaAlAs emitting diode operating at peak emission wavelength of 890nm and $E_{e(APT)}$ of 1.7mW/cm² average within a .250" dia. aperture.
(4) This dimension is held to within ± 0.005" on the flange edge and may vary up to ± 0.020" in the area of the leads.

### Typical Performance Curves

**Typical Spectral Response**




**Normalized Collector Current vs. Ambient Temperature**

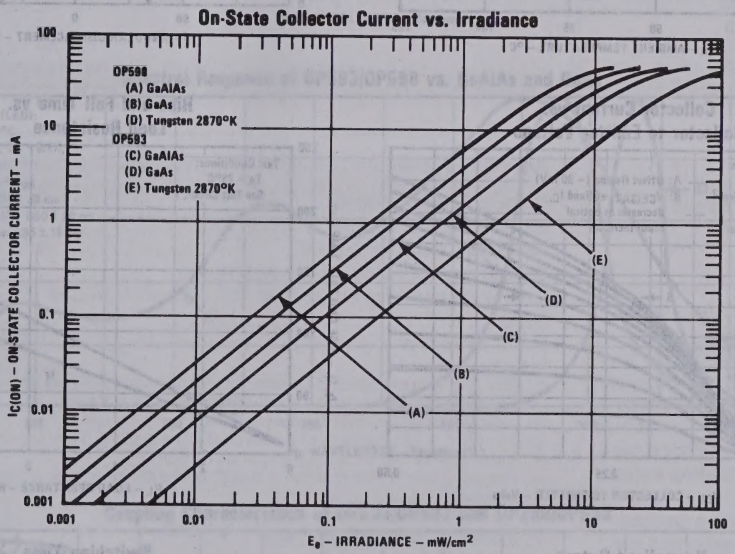


# Types OP593, OP598 Series

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$ | On-State Collector Current | OP593C | 1.0 | | | mA | See Note (3) |
| | | OP593B | 2.0 | | 4.0 | mA | See Note (3) |
| | | OP593A | 3.0 | | | mA | See Note (3) |
| | | OP598C | 2.5 | | | mA | See Note (3) |
| | | OP598B | 5.0 | | 10.0 | mA | See Note (3) |
| | | OP598A | 7.5 | | | mA | See Note (3) |
| $I_{CEO}$ | Collector Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | | 0.40 | V | $I_C$ = 0.40mA, $E_e$ = 1.7mW/cm$^2$(3) |

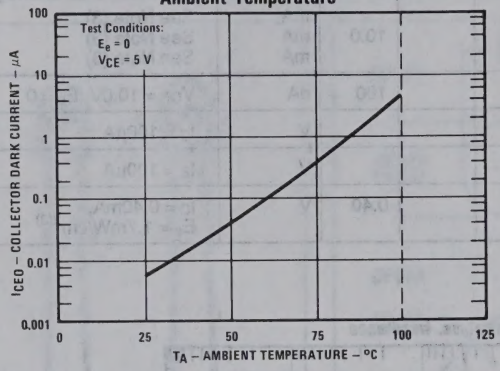
**Typical Performance Curves**



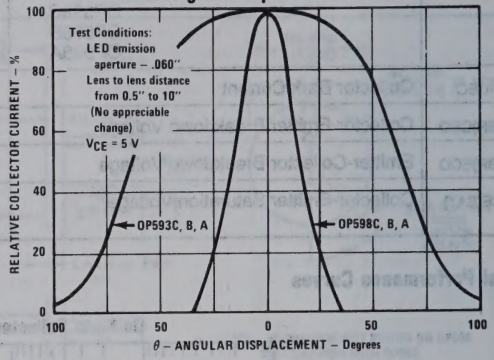

PHOTOSENSORS

## Typical Performance Curves

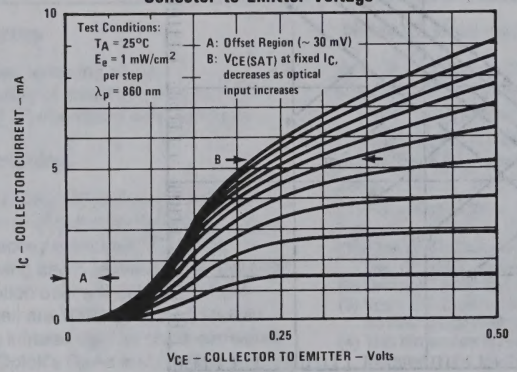
### Collector Dark Current vs. Ambient Temperature



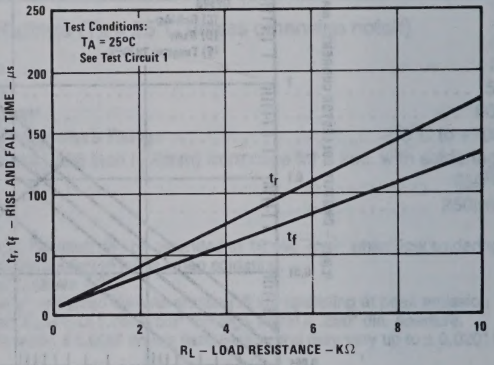

### Relative Collector Current vs. Angular Displacement



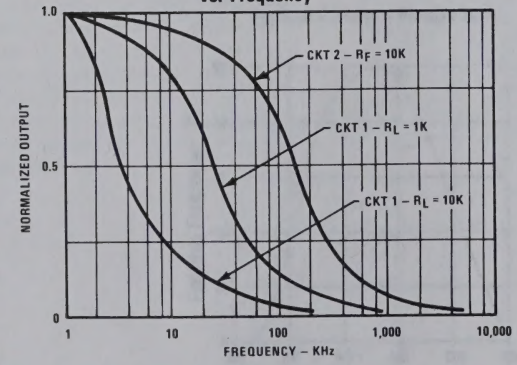

### Collector Current vs. Collector to Emitter Voltage



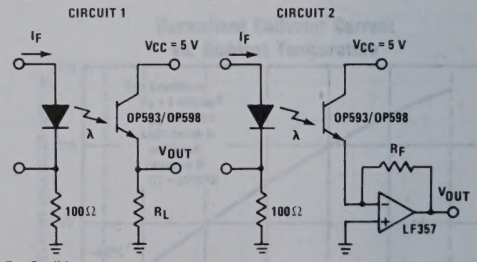

### Rise and Fall Time vs. Load Resistance




### Normalized Output vs. Frequency



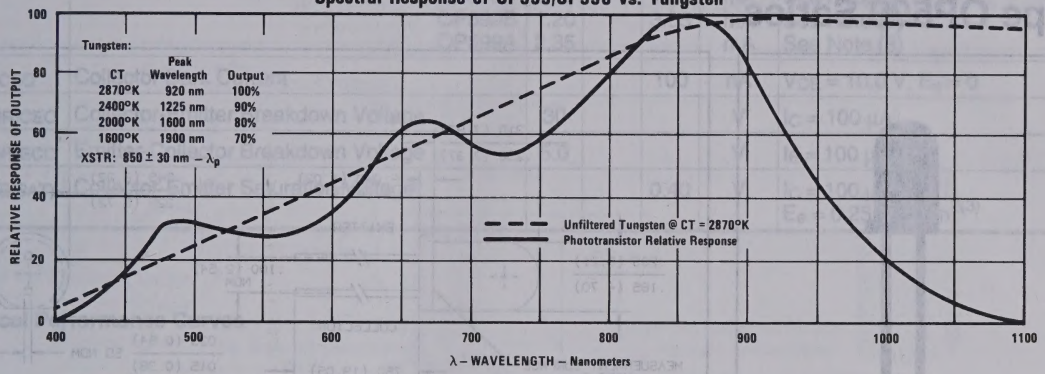

### Switching Time Test Circuit



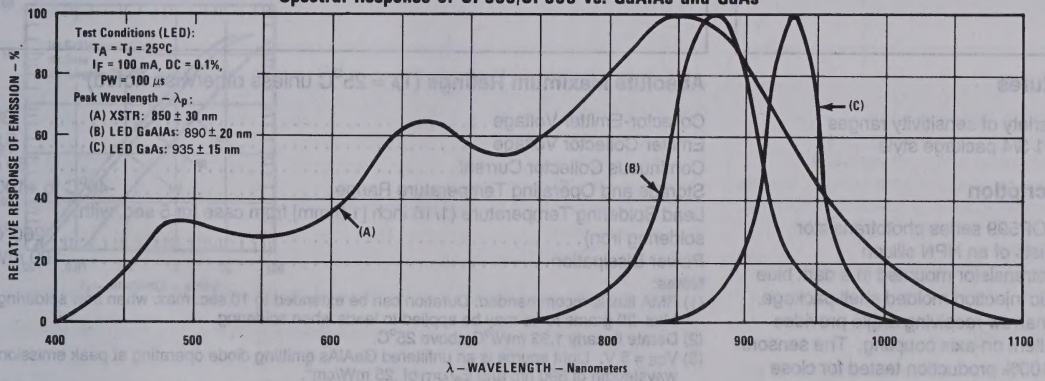

Test Conditions:
Light source is pulsed LED with $t_r$ and $t_f \leq 500$ ns.
$I_F$ is adjusted for $V_{OUT} = 1$ Volt.

## Typical Performance Curves

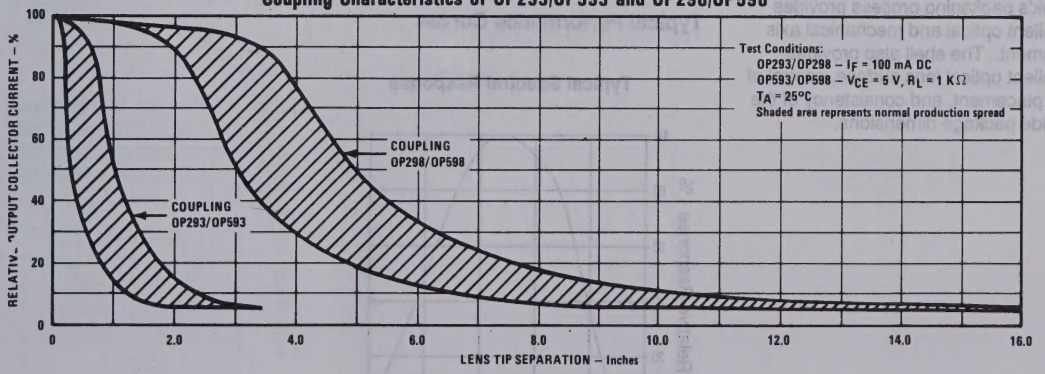
### Spectral Response of OP593/OP598 vs. Tungsten


Tungsten:
CT | Peak Wavelength | Output
2870°K | 920 nm | 100%
2400°K | 1225 nm | 90%
2000°K | 1600 nm | 80%
1600°K | 1900 nm | 70%
XSTR: 850 ± 30 nm – λp
Unfiltered Tungsten @ CT = 2870°K
Phototransistor Relative Response
RELATIVE RESPONSE OF OUTPUT
λ – WAVELENGTH – Nanometers

### Spectral Response of OP593/OP598 vs. GaAlAs and GaAs

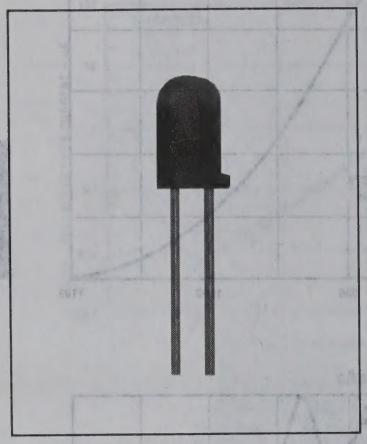

Test Conditions (LED):
TA = TJ = 25°C
IF = 100 mA, DC = 0.1%,
PW = 100 μs
Peak Wavelength – λp:
(A) XSTR: 850 ± 30 nm
(B) LED GaAlAs: 890 ± 20 nm
(C) LED GaAs: 935 ± 15 nm
(A)
(B)
(C)
RELATIVE RESPONSE OF EMISSION – %
λ – WAVELENGTH – Nanometers

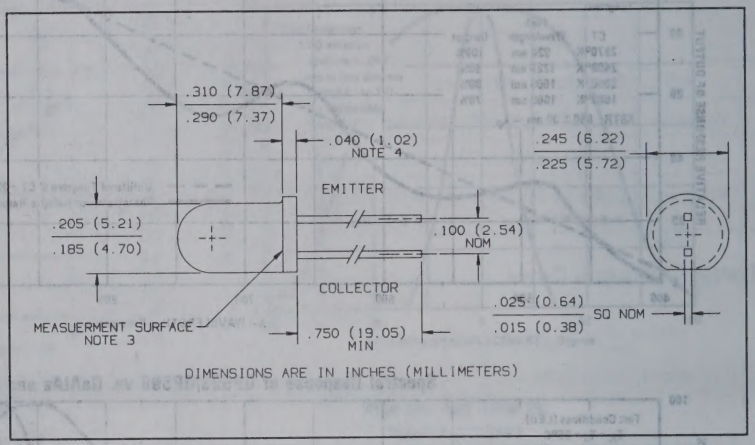
### Coupling Characteristics of OP293/OP593 and OP298/OP598




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# NPN Plastic Silicon Phototransistors
## Type OP599 Series






### Features

- Variety of sensitivity ranges
- T-1 3/4 package style

### Description

The OP599 series phototransistor consists of an NPN silicon phototransistor mounted in a dark blue plastic injection molded shell package. The narrow receiving angle provides excellent on-axis coupling. The sensors are 100% production tested for close correlation with Optek GaAlAs emitters.

Optek's packaging process provides excellent optical and mechanical axis alignment. The shell also provides excellent optical lens surface, control of chip placement, and consistency of the outside package dimensions.

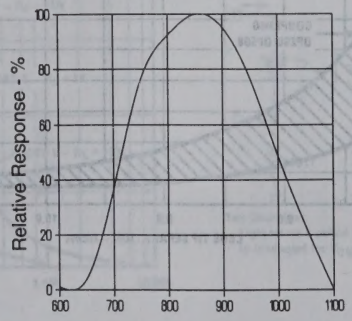
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 30 V |
| Emitter-Collector Voltage | 5.0 V |
| Continuous Collector Current | 50 mA |
| Storage and Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature (1/16 inch [1.6 mm] from case for 5 sec. with soldering iron) | 260°C(1) |
| Power Dissipation | 100 mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) $V_{CE}$ = 5 V. Light source is an unfiltered GaAlAs emitting diode operating at peak emission wavelength of 890 nm and $E_{e(APT)}$ of .25 mW/cm².
(4) This dimension is held to within ± 0.005" on the flange edge and may vary up to ± 0.020" in the area of the leads.

### Typical Performance Curves

**Typical Spectral Response**



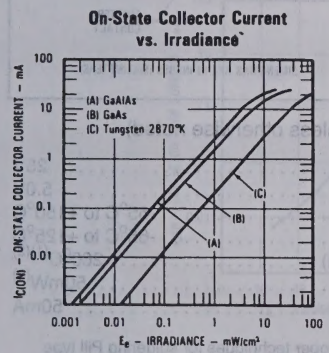
# Types OP599

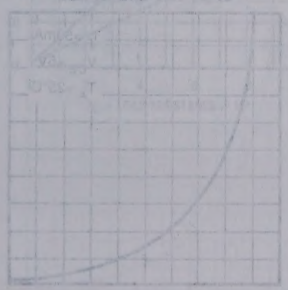
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

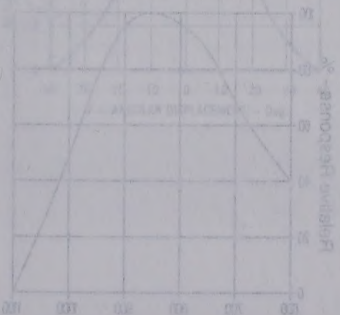
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$ | On-State Collector Current | OP599D | 0.20 | | | mA | See Note (3) |
| | | OP599C | 0.40 | | 1.95 | mA | See Note (3) |
| | | OP599B | 1.20 | | 3.85 | mA | See Note (3) |
| | | OP599A | 2.35 | | | mA | See Note (3) |
| $I_{CEO}$ | Collector Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0 V, $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | | V | $I_C$ = 100 µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100 µA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | | 0.40 | V | $I_C$ = 100 µA<br>$E_e$ = 0.25 mW/cm$^2$(3) |

PHOTOSENSORS

## Typical Performance Curves

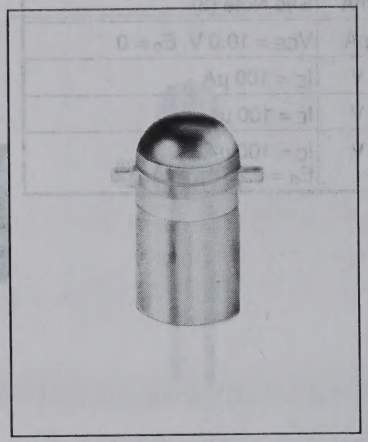


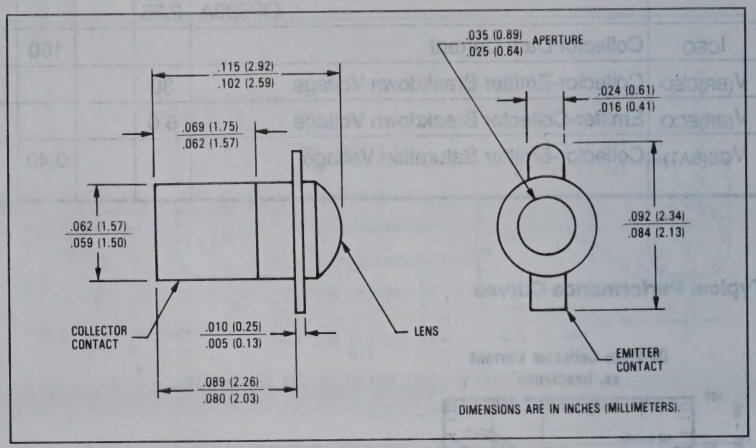





Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# NPN Silicon Phototransistors
## Types OP600A, OP600B, OP600C






### Features

- Narrow receiving angle
- Variety of sensitivity ranges
- Enhanced temperature range
- Ideal for direct mounting in PC boards
- Mechanically and spectrally matched to the OP123 and OP223 series devices
- TX/TXV processing available (see Hi-Rel section)

### Description

The OP600 series device consists of an NPN silicon phototransistor mounted in a hermetically sealed "Pill" type package. The narrow receiving angle provides excellent on-axis coupling. These devices are 100% production tested using infrared light for close correlation with Optek GaAs and GaAlAs emitters.

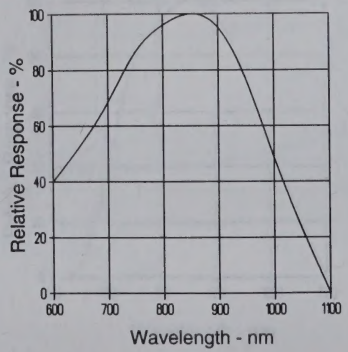
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 25V |
| Emitter-Collector Voltage | 5.0V |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Soldering Temperature (5 sec. with soldering iron) | 260°C(1)(2) |
| Power Dissipation | 50mW(3) |
| Continuous Collector Current | 50mA |

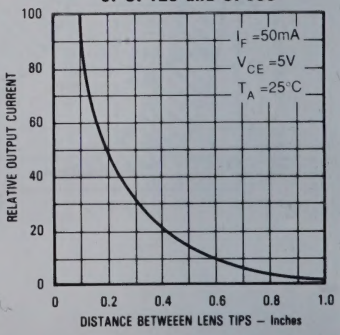
**Notes:**
(1) Refer to Application Bulletin 202 which discusses proper techniques for soldering Pill type devices to PC boards.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.5mW/°C above 25°C.
(4) Junction temperature maintained at 25°C.
(5) Light source is a GaAlAs LED, peak Wavelength = 890nm, providing an irradiance of 2.5mW/cm². The source irradiance is not necessarily uniform over the entire lens area of the unit under test.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP123 and OP600**



# Types OP600A, OP600B, OP600C

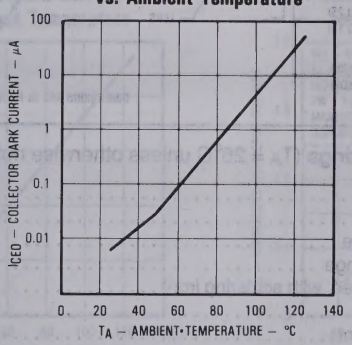
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$[4] | On-State Collector Current | OP600C | 0.30 | | | mA | $V_{CE}$ = 5V, $E_e$ = 2.5mW/cm$^2$[5] |
| | | OP600B | 0.60 | | 1.8 | mA | $V_{CE}$ = 5V, $E_e$ = 2.5mW/cm$^2$[5] |
| | | OP600A | 1.20 | | | mA | $V_{CE}$ = 5V, $E_e$ = 2.5mW/cm$^2$[5] |
| $I_{CEO}$ | Collector Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 25 | | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA |
| $V_{CE(SAT)}$[4] | Collector-Emitter Saturation Voltage | | | | 0.40 | V | $I_C$ =0.15mA, $E_e$=2.5mW/cm$^2$[5] |
| $t_r$ | Rise Time | | | 15.0 | | µs | $V_{CC}$ = 5.0V, $I_C$ = 0.80mA, |
| $t_f$ | Fall Time | | | 15.0 | | µs | $R_L$ = 1.0kΩ, See Test Circuit |

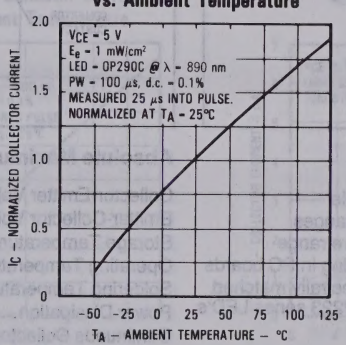
PHOTOSENSORS

## Typical Performance Curves

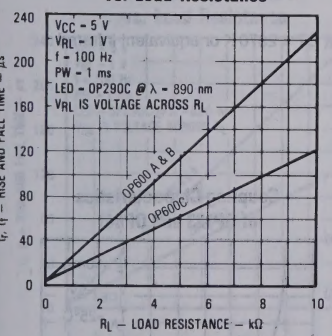
**Collector Dark Current vs. Ambient Temperature**



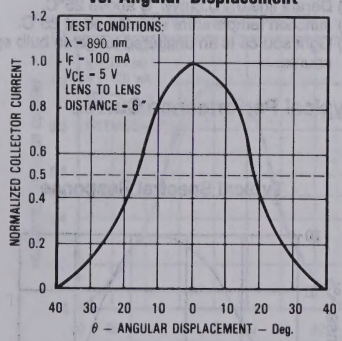

**Normalized Collector Current vs. Ambient Temperature**


$V_{CE}$ = 5 V
$E_e$ = 1 mW/cm²
LED = OP290C @ λ = 890 nm
PW = 100 µs, d.c. = 0.1%
MEASURED 25 µs INTO PULSE.
NORMALIZED AT $T_A$ = 25°C
2.0
1.5
1.0
0.5
0
$I_C$ – NORMALIZED COLLECTOR CURRENT
-50 -25 0 25 50 75 100 125
$T_A$ – AMBIENT TEMPERATURE – °C

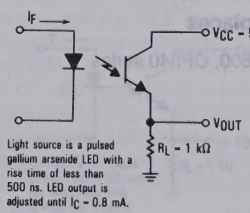
**Rise and Fall Time vs. Load Resistance**




**Normalized Collector Current vs. Angular Displacement**

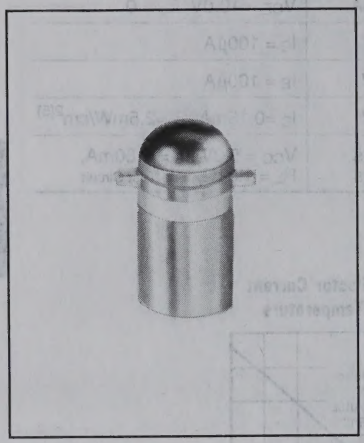


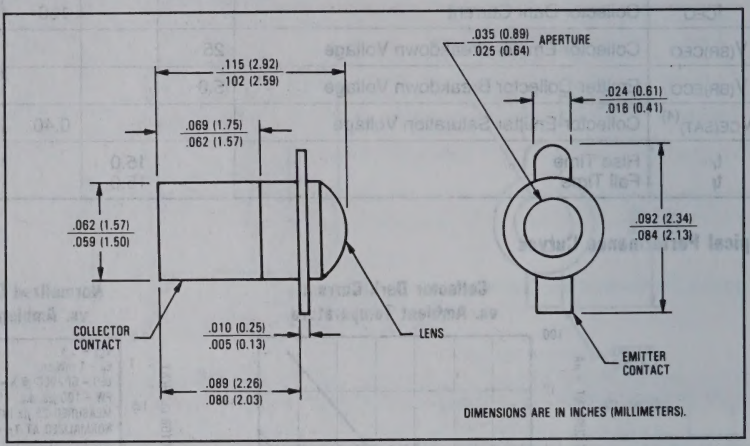

**Switching Time Test Circuit**


$I_F$
$V_{CC}$ – 5 V
$V_{OUT}$
$R_L$ – 1 kΩ
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until $I_C$ = 0.8 mA.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# NPN Silicon Phototransistors
## Types OP641SL, OP642SL, OP643SL, OP644SL






### Features

- Narrow receiving angle
- Variety of sensitivity ranges
- Enhanced temperature range
- Ideal for direct mounting in PC boards
- Mechanically and spectrally matched to the OP123 and OP223 series LED's

### Description

The OP641SL series devices consist of NPN silicon phototransistors mounted in hermetically sealed packages. The narrow receiving angle provides excellent on-axis coupling.

### Replaces

OP600, OP640 series

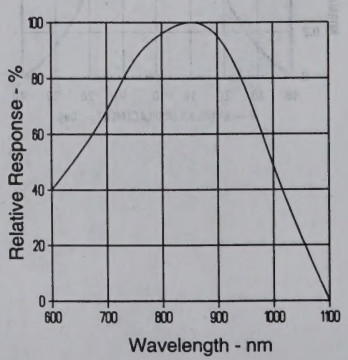
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 25V |
| Emitter-Collector Voltage | 5.0V |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Soldering Temperature (5 sec. with soldering iron) | 260°C(1)(2) |
| Power Dissipation | 50mW(3) |
| Continuous Collector Current | 50mA |

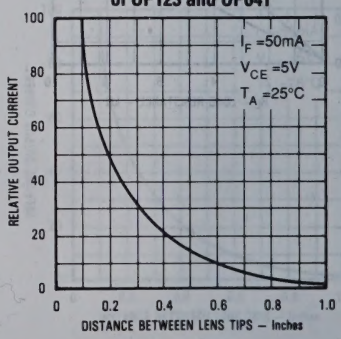
**Notes:**
(1) Refer to Application Bulletin 202 which discusses proper techniques for soldering Pill type devices to PC boards.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.5mW/°C above 25°C.
(4) Junction temperature maintained at 25°C.
(5) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP123 and OP641**



# Types OP641SL, OP642SL, OP643SL, OP644SL

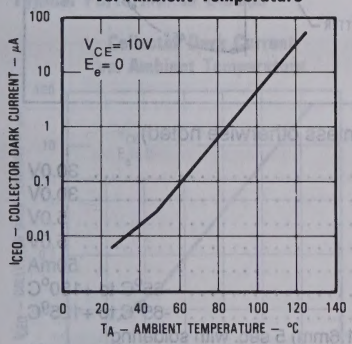
**Electrical Characteristics** ($T_A = 25°C$ unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$[4] | On-State Collector Current | OP641SL | 0.5 | | 3.0 | mA | $V_{CE} = 5V$, $E_e = 20mW/cm^2$[5] |
| | | OP642SL | 2.0 | | 5.0 | mA | $V_{CE} = 5V$, $E_e = 20mW/cm^2$[5] |
| | | OP643SL | 4.0 | | 8.0 | mA | $V_{CE} = 5V$, $E_e = 20mW/cm^2$[5] |
| | | OP644SL | 7.0 | | 22.0 | mA | $V_{CE} = 5V$, $E_e = 20mW/cm^2$[5] |
| $I_{CEO}$ | Collector Dark Current | | | | 100 | nA | $V_{CE} = 10.0V$, $E_e = 0$ |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 25 | | | V | $I_C = 100\mu A$ |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E = 100\mu A$ |
| $V_{CE(SAT)}$[4] | Collector-Emitter Saturation Voltage | | | | 0.40 | V | $I_C = 0.4mA$, $E_e = 20mW/cm^2$[5] |
| $t_r$ | Rise Time | | | 15.0 | | µs | $V_{CC} = 5.0V$, $I_C = 0.80mA$, |
| $t_f$ | Fall Time | | | 15.0 | | µs | $R_L = 1.0k\Omega$, (See Test Circuit) |

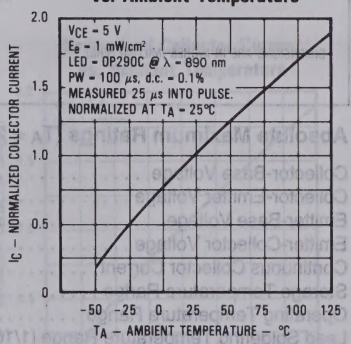
PHOTOSENSORS

## Typical Performance Curves

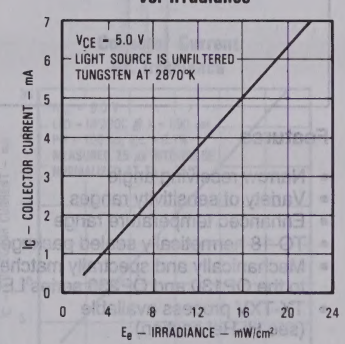
**Collector Dark Current vs. Ambient Temperature**



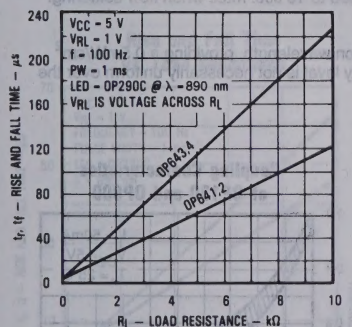

**Normalized Collector Current vs. Ambient Temperature**


$V_{CE}$ = 5 V
$E_e$ = 1 mW/cm²
LED – OP290C @ λ = 890 nm
PW = 100 µs, d.c. = 0.1%
MEASURED 25 µs INTO PULSE.
NORMALIZED AT $T_A$ = 25°C
$I_C$ – NORMALIZED COLLECTOR CURRENT
2.0
1.5
1.0
0.5
0
-50 -25 0 25 50 75 100 125
$T_A$ – AMBIENT TEMPERATURE – °C

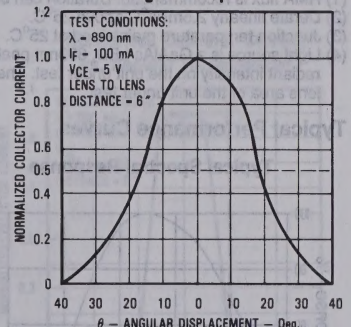
**Collector Current vs. Irradiance**



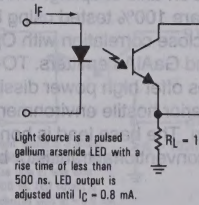

**Rise and Fall Time vs. Load Resistance**




**Normalized Collector Current vs. Angular Displacement**

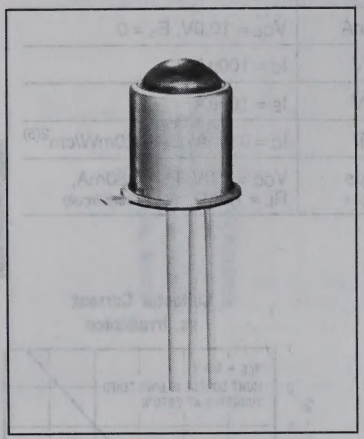


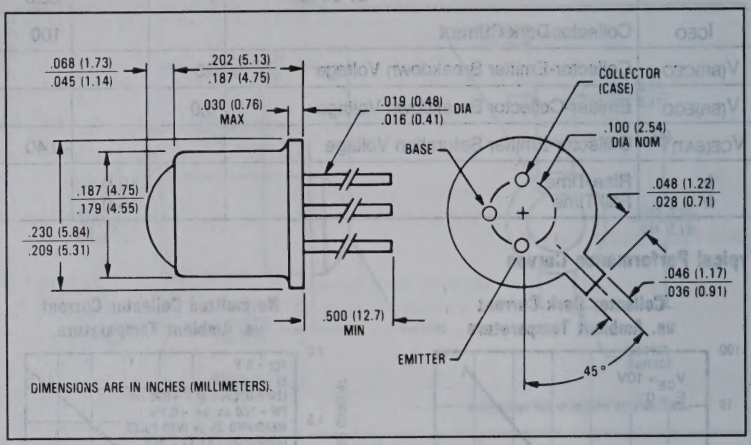

**Switching Time Test Circuit**


$I_F$
$V_{CC}$ = 5 V
$V_{OUT}$
$R_L$ = 1 kΩ
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until $I_C$ = 0.8 mA.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# NPN Silicon Phototransistors
## Types OP800A, OP800B, OP800C, OP800D






### Features

- Narrow receiving angle
- Variety of sensitivity ranges
- Enhanced temperature range
- TO-18 hermetically sealed package
- Mechanically and spectrally matched to the OP130 and OP230 series LED's
- TX-TXV process available (see Hi-Rel section)

### Description

The OP800 series devices consist of NPN silicon phototransistors mounted in hermetically sealed packages. The narrow receiving angle provides excellent on-axis coupling. These devices are 100% tested using infrared light for close correlation with Optek GaAs and GaAlAs emitters. TO-18 packages offer high power dissipation and superior hostile environment operation. The base lead is bonded to enable conventional transistor biasing.

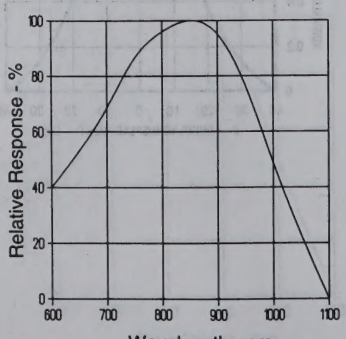
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Base Voltage | 30.0V |
| Collector-Emitter Voltage | 30.0V |
| Emitter-Base Voltage | 5.0V |
| Emitter-Collector Voltage | 5.0V |
| Continuous Collector Current | 50mA |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Lead Soldering Temperature Range [1/16 inch (1.6mm) 5 sec. with soldering iron] | 260°C(2) |
| Power Dissipation | 250mW(3) |

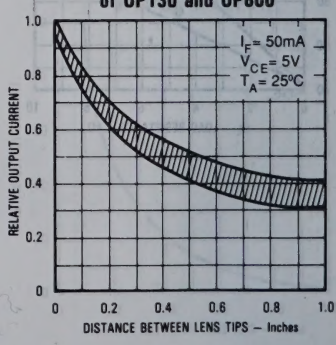
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.5mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is a GaAlAs LED, 890nm peak emission wavelength, providing a 0.5mW/cm² radiant intensity on the unit under test. The intensity level is not necessarily uniform over the lens area of the unit under test.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP130 and OP800**



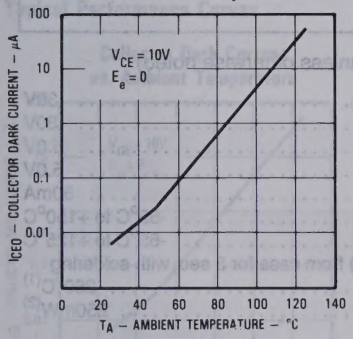
# Types OP800A, OP800B, OP800C, OP800D

**Electrical Characteristics** ($T_A = 25°C$ unless otherwise noted)

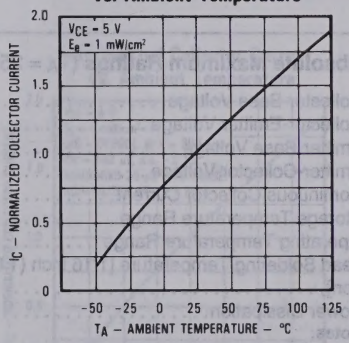
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$[3] | On-State Collector Current | OP800D | 0.45 | | | mA | $V_{CE} = 5V$, $E_e = 0.5mW/cm^2$[4] |
| | | OP800C | 0.90 | | 3.60 | mA | $V_{CE} = 5V$, $E_e = 0.5mW/cm^2$[4] |
| | | OP800B | 1.80 | | 5.40 | mA | $V_{CE} = 5V$, $E_e = 0.5mW/cm^2$[4] |
| | | OP800A | 3.60 | | | mA | $V_{CE} = 5V$, $E_e = 0.5mW/cm^2$[4] |
| $I_{CEO}$ | Collector Dark Current | | | | 100 | nA | $V_{CE} = 10.0V$, $E_e = 0$ |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | | V | $I_C = 100\mu A$ |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | | 30 | | | V | $I_C = 100\mu A$ |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E = 100\mu A$ |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | | 5.0 | | | V | $I_E = 100\mu A$ |
| $V_{CE(SAT)}$[3] | Collector-Emitter Saturation Voltage | | | | 0.40 | V | $I_C = 0.15mA$, $E_e = 0.5mW/cm^2$[4] |
| $t_r$ | Rise Time | | | 7.0 | | µs | $V_{CC} = 5V$, $I_C = 0.80mA$, |
| $t_f$ | Fall Time | | | 7.0 | | µs | $R_L = 100\Omega$, (See Test Circuit) |

## Typical Performance Curves

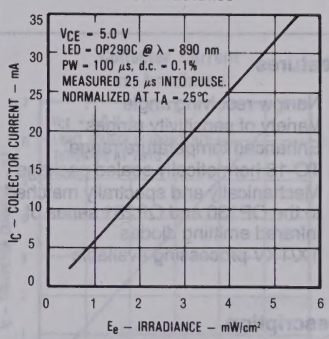
**Collector Dark Current vs. Ambient Temperature**



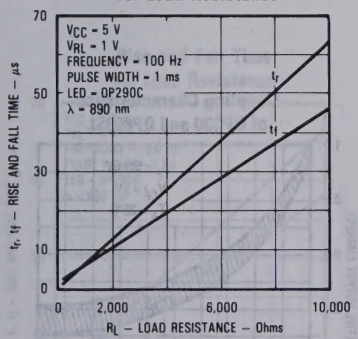

**Normalized Collector Current vs. Ambient Temperature**



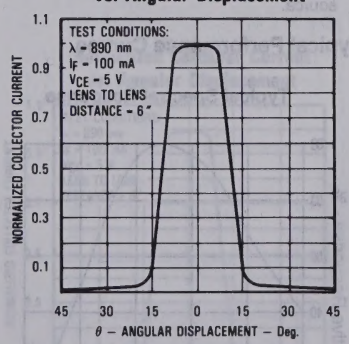

**Collector Current vs. Irradiance**



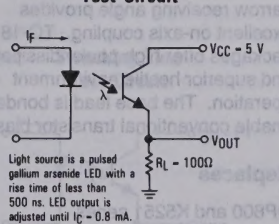

**Rise and Fall Time vs. Load Resistance**




**Normalized Collector Current vs. Angular Displacement**




**Switching Time Test Circuit**


$I_F$
$V_{CC}$ = 5 V
λ
$V_{OUT}$
$R_L$ = 100Ω
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until $I_C$ = 0.8 mA.

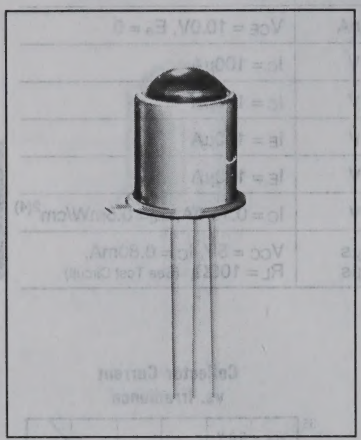
PHOTOSENSORS

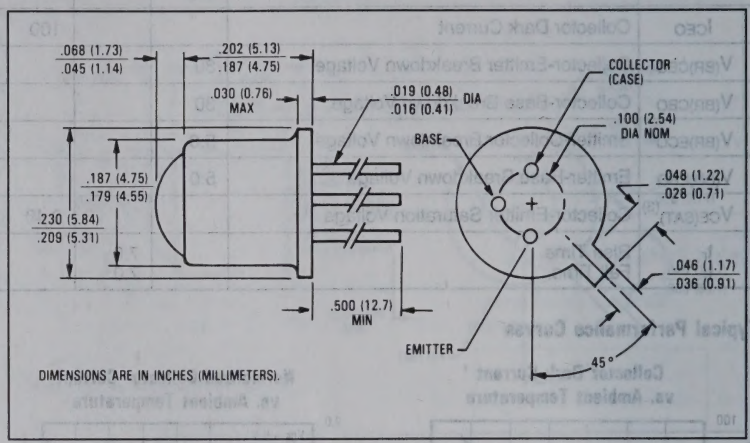
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

# NPN Silicon Phototransistors

## Types OP800SL, OP801SL, OP802SL, OP803SL, OP804SL, OP805SL






### Features

- Narrow receiving angle
- Variety of sensitivity ranges
- Enhanced temperature range
- TO-18 hermetically sealed package
- Mechanically and spectrally matched to the OP130 and OP231 series of infrared emitting diodes
- TX/TXV processing available

### Description

The OP800SL series device consists of an NPN silicon phototransistor mounted in a hermetically sealed package. The narrow receiving angle provides excellent on-axis coupling. TO-18 packages offer high power dissipation and superior hostile environment operation. The base lead is bonded to enable conventional transistor biasing.

### Replaces

OP800 and K5251 series

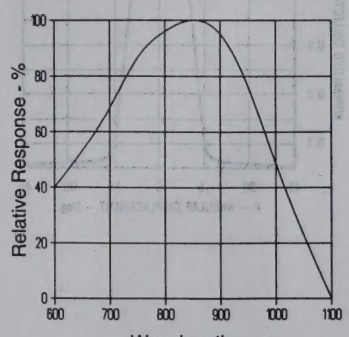
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Base Voltage | 30V |
| Collector-Emitter Voltage | 30V |
| Emitter-Base Voltage | 5.0V |
| Emitter-Collector Voltage | 5.0V |
| Continuous Collector Current | 50mA |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 250mW(2) |

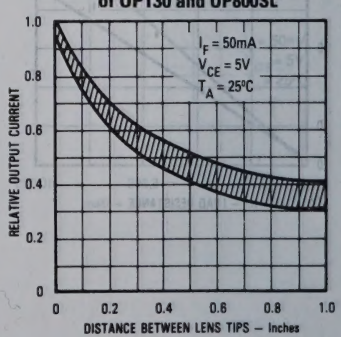
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.5mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP130 and OP800SL**



# Types OP800SL thru OP805SL

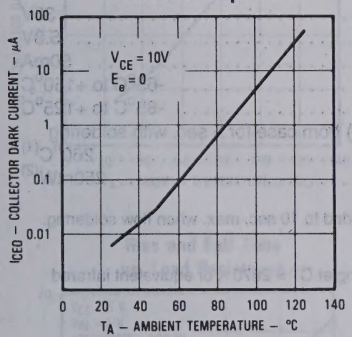
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$ | On-State Collector Current | OP800SL | 0.5 | | | mA | $V_{CE}$ = 5V, $E_e$ = 5mW/cm$^{2(3)(4)}$ |
| | | OP801SL | 0.5 | | 3.0 | mA | $V_{CE}$ = 5V, $E_e$ = 5mW/cm$^{2(3)(4)}$ |
| | | OP802SL | 2.0 | | 5.0 | mA | $V_{CE}$ = 5V, $E_e$ = 5mW/cm$^{2(3)(4)}$ |
| | | OP803SL | 4.0 | | 8.0 | mA | $V_{CE}$ = 5V, $E_e$ = 5mW/cm$^{2((3)4)}$ |
| | | OP804SL | 7.0 | | 22.0 | mA | $V_{CE}$ = 5V, $E_e$ = 5mW/cm$^{2((3)4)}$ |
| | | OP805SL | 15.0 | | | mA | $V_{CE}$ = 5V, $E_e$ = 5mW/cm$^{2((3)4)}$ |
| $I_{CEO}$ | Collector Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | | V | $I_C$ = 100µA |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | | 30 | | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | | 0.4 | V | $I_C$ = 0.40mA, $E_e$ = 5.0mW/cm$^{2(4)}$ |
| $t_r$ | Rise Time | | | 7.0 | | µs | $V_{CC}$ = 5.0V, $I_C$ = 0.80mA |
| $t_f$ | Fall Time | | | 7.0 | | µs | $R_L$ = 100Ω, See Test Circuit |

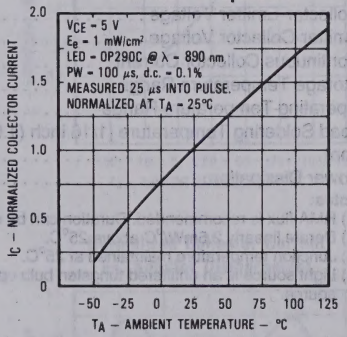
PHOTOSENSORS

## Typical Performance Curves

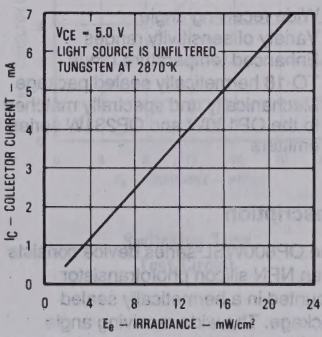
**Collector Dark Current vs. Ambient Temperature**



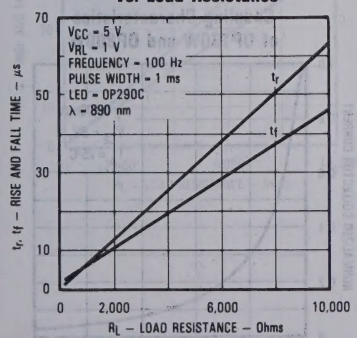

**Normalized Collector Current vs. Ambient Temperature**



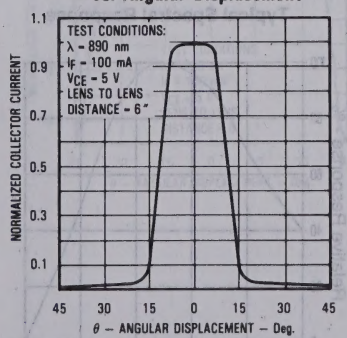

**Collector Current vs. Irradiance**



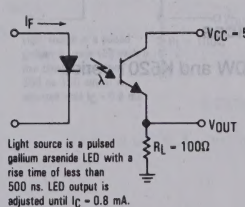

**Rise and Fall Time vs. Load Resistance**




**Normalized Collector Current vs. Angular Displacement**

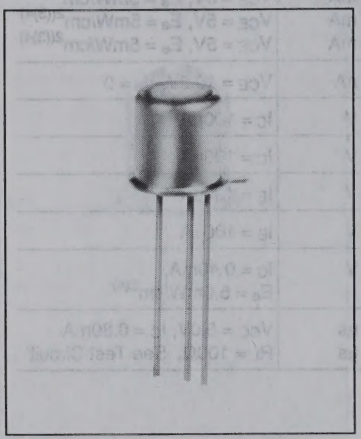


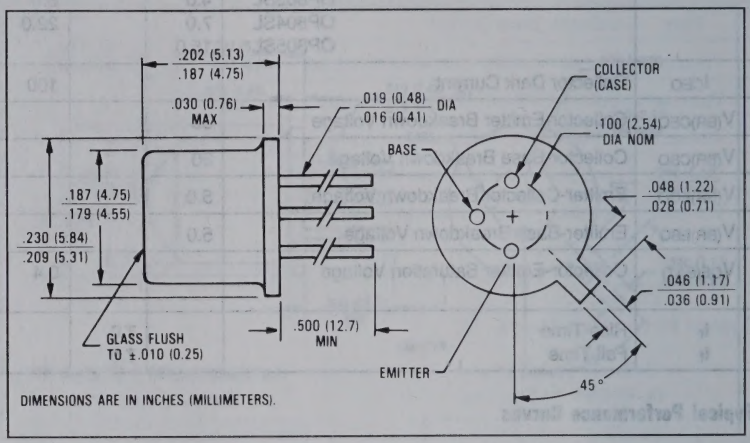

**Switching Time Test Circuit**


$I_F$
$V_{CC}$ = 5 V
λ
$V_{OUT}$
$R_L$ = 100Ω
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until $I_C$ = 0.8 mA.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# NPN Silicon Phototransistors
## Types OP800WSL, OP801WSL, OP802WSL






### Features

- Wide receiving angle
- Variety of sensitivity ranges
- Enhanced temperature range
- TO-18 hermetically sealed package
- Mechanically and spectrally matched to the OP130W and OP231W series emitters

### Description

The OP800WSL series device consists of an NPN silicon phototransistor mounted in a hermetically sealed package. The wide receiving angle provides relatively even reception over a large area. TO-18 packages offer high power dissipation and superior hostile environment operation.

### Replaces

OP800W and K5201 series

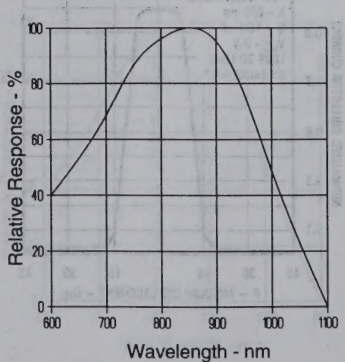
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Continuous Collector Current | 50mA |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 250mW(2) |

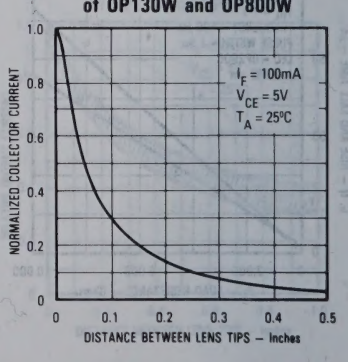
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.5mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP130W and OP800W**



# Types OP800WSL, OP801WSL, OP802WSL

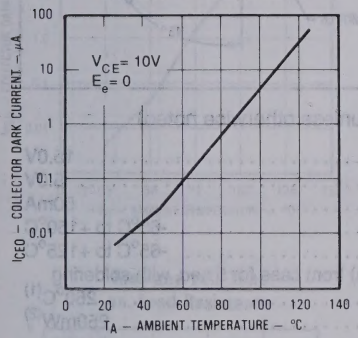
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| $I_{C(ON)}$[3] | On-State Collector Current | OP800WSL | 0.3 | | | mA | $V_{CE}$ = 5V, $E_e$ = 5mW/cm$^2$[4] |
| | | OP801WSL | 0.5 | | 3.0 | mA | $V_{CE}$ = 5V, $E_e$ = 5mW/cm$^2$[4] |
| | | OP802WSL | 2.5 | | | mA | $V_{CE}$ = 5V, $E_e$ = 5mW/cm$^2$[4] |
| $I_{CEO}$ | Collector Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA |
| $V_{CE(SAT)}$[3] | Collector-Emitter Saturation Voltage | | | | 0.4 | V | $I_C$ = 0.40mA, $E_e$ = 5.0mW/cm$^2$[4] |
| $t_r$ | Rise Time | | | 7.0 | | µs | $V_{CC}$ = 5.0V, $I_C$ = 0.80mA |
| $t_f$ | Fall Time | | | 7.0 | | µs | $R_L$ = 100Ω, See Test Circuit |

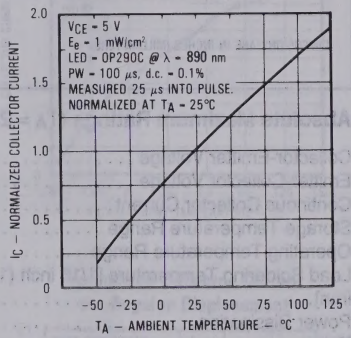


## Typical Performance Curves

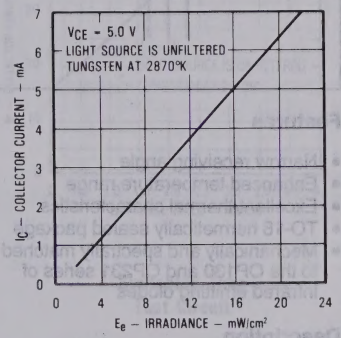
**Collector Dark Current vs. Ambient Temperature**



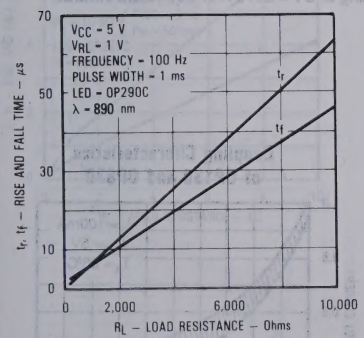

**Normalized Collector Current vs. Ambient Temperature**



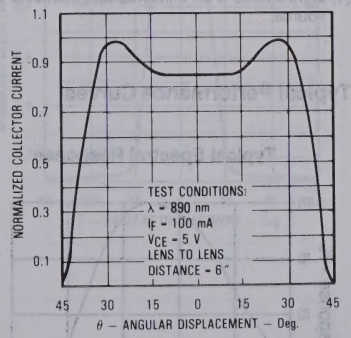

**Collector Current vs. Irradiance**



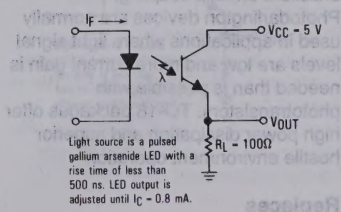

**Rise and Fall Time vs. Load Resistance**




**Normalized Collector Current vs. Angular Displacement**

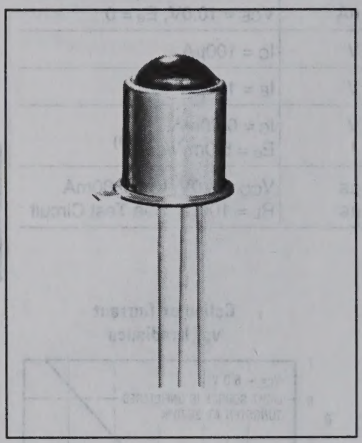


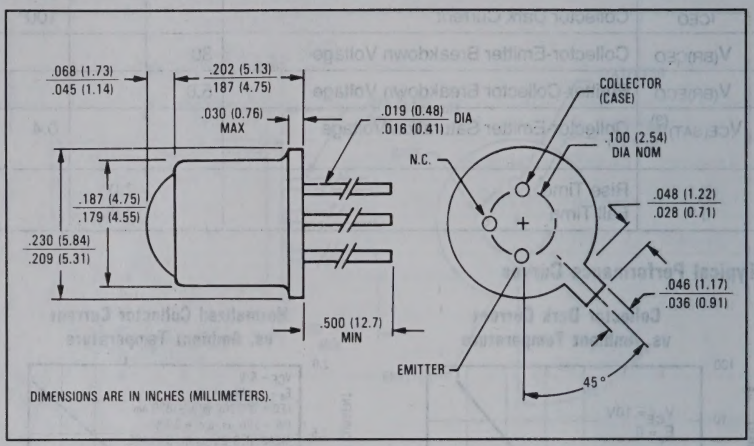

**Switching Time Test Circuit**


$I_F$
$V_{CC}$ = 5 V
λ
$V_{OUT}$
$R_L$ = 100Ω
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until $I_C$ = 0.8 mA.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# NPN Silicon Photodarlington
## Type OP830SL






### Features

- Narrow receiving angle
- Enhanced temperature range
- Excellent thermal characteristics
- TO-18 hermetically sealed package
- Mechanically and spectrally matched to the OP130 and OP231 series of infrared emitting diodes

### Description

The OP830SL consists of an NPN silicon photodarlington mounted in a hermetically sealed package. The narrow receiving angle provides excellent on-axis coupling. Photodarlington devices are normally used in applications where light signal levels are low and more current gain is needed than is possible with phototransistors. TO-18 packages offer high power dissipation and superior hostile environment operation.

### Replaces

OP830 and K9020 series

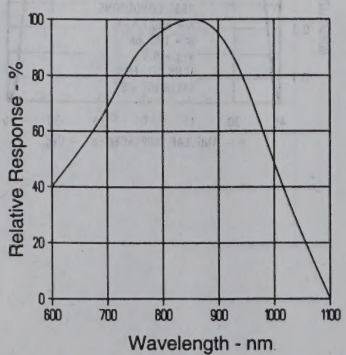
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 15.0V |
| Emitter-Collector Voltage | 5.0V |
| Continous Collector Current | 50mA |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 250mW(2) |

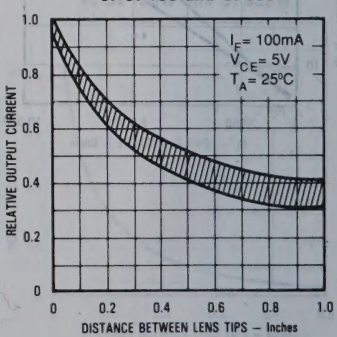
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.5 mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP130 and OP830**



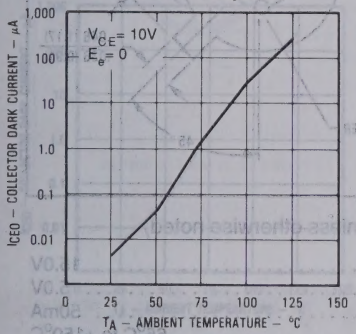
# Type OP830SL

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

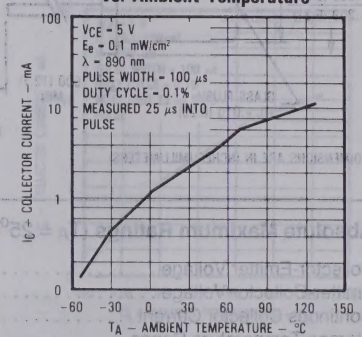
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $I_{C(ON)}$[3] | On-State Collector Current | 15.0 | | | mA | $V_{CE}$ = 5V, $E_e$ = 0.50mW/cm$^2$[4] |
| $I_{CEO}$ | Collector Dark Current | | | 1.0 | µA | $V_{CE}$ = 10.0V, $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 15.0 | | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | | V | $I_E$ = 100µA |
| $V_{CE(SAT)}$[3] | Collector-Emitter Saturation Voltage | | | 1.20 | V | $I_C$ = 1.00mA, $E_e$ = 0.50mW/cm$^2$[4] |

## Typical Performance Curves

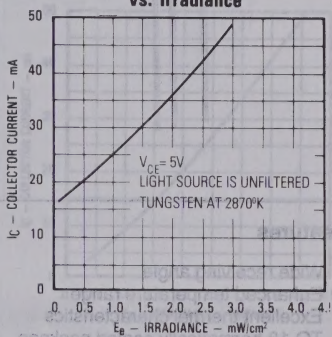
**Collector Dark Current vs. Ambient Temperature**



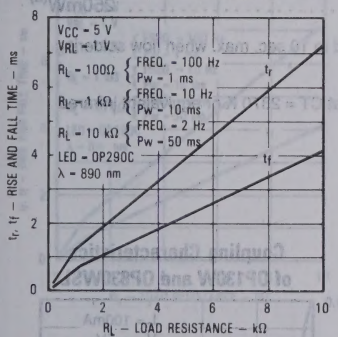

**Collector Current vs. Ambient Temperature**



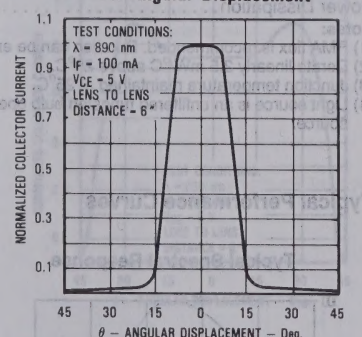

**Collector Current vs. Irradiance**



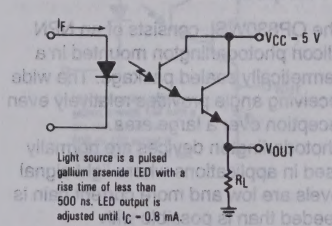

**Rise and Fall Time vs. Load Resistance**




**Normalized Collector Current vs. Angular Displacement**



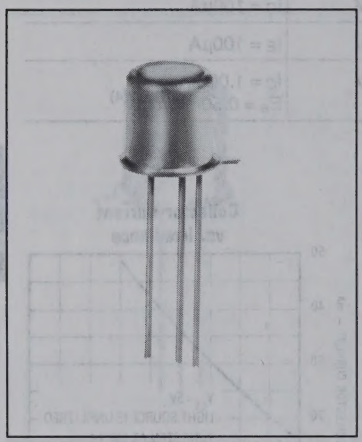

**Switching Time Test Circuit**

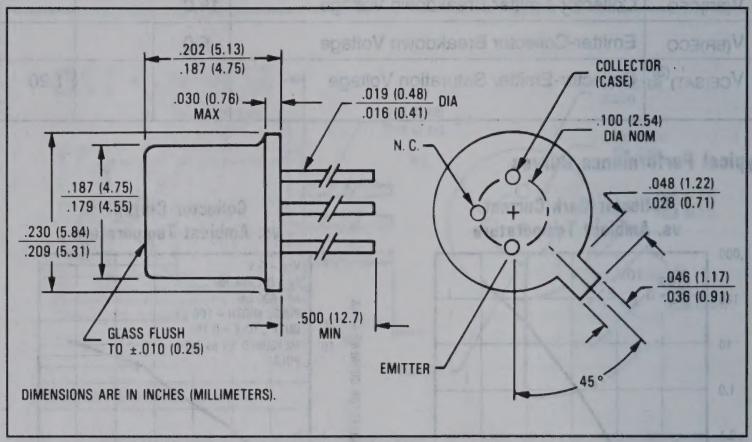

$I_F$
$V_{CC}$ = 5 V
$V_{OUT}$
$R_L$
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until $I_C$ = 0.8 mA.

PHOTOSENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# NPN Silicon Photodarlington
## Type OP830WSL






### Features

- Wide receiving angle
- Enhanced temperature range
- Excellent thermal characteristics
- TO-18 hermetically sealed package
- Mechanically and spectrally matched to the OP130W and OP231W series of infrared emitting diodes

### Description

The OP830WSL consists of an NPN silicon photodarlington mounted in a hermetically sealed package. The wide receiving angle provides relatively even reception over a large area. Photodarlington devices are normally used in applications where light signal levels are low and more current gain is needed than is possible with phototransistors. TO-18 packages offer high power dissipation and superior hostile environment operation.

### Replaces

OP830W and K9030 series

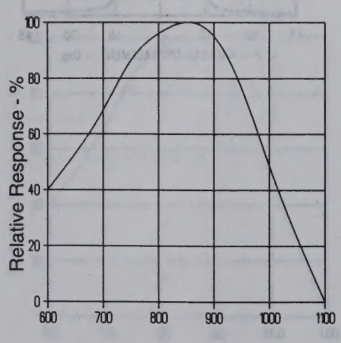
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 15.0V |
| Emitter-Collector Voltage | 5.0V |
| Continous Collector Current | 50mA |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 250mW(2) |

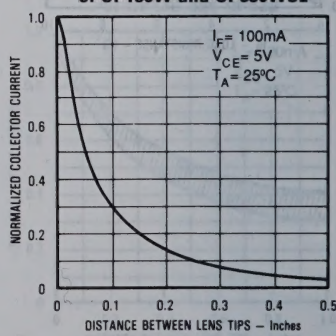
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.5 mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP130W and OP830WSL**



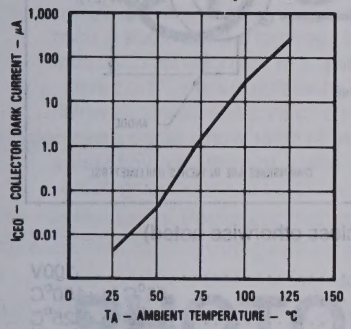
# OP830WSL

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

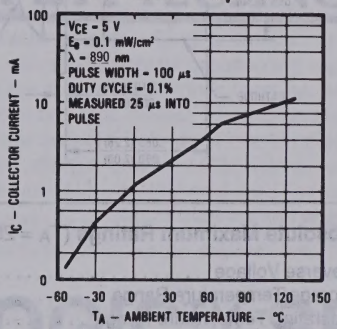
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $I_{C(ON)}$ [3] | On-State Collector Current | 4.0 | | | mA | $V_{CE}$ = 5V, $E_e$ = 0.50mW/cm$^2$ [4] |
| $I_{CEO}$ | Collector Dark Current | | | 1.0 | µA | $V_{CE}$ = 10.0V |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 15.0 | | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | | V | $I_E$ = 100µA |
| $V_{CE(SAT)}$ [3] | Collector-Emitter Saturation Voltage | | | 1.20 | V | $I_C$ = 1.00mA, $E_e$ = 0.50mW/cm$^2$ [4] |

## Typical Performance Curves

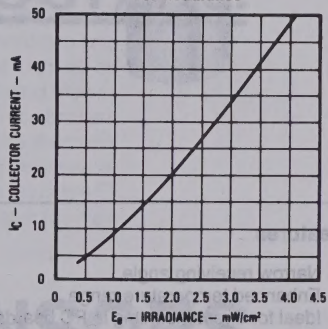
**Collector Dark Current vs. Ambient Temperature**



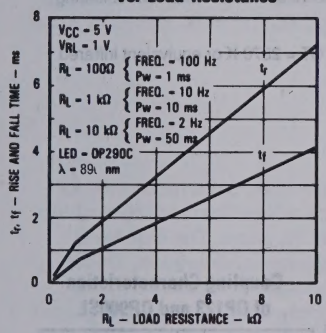

**Collector Current vs. Ambient Temperature**



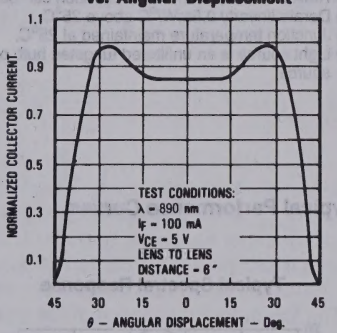

**Collector Current vs. Irradiance**



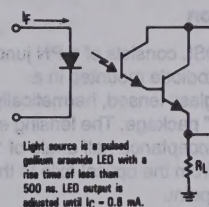

**Rise and Fall Time vs. Load Resistance**




**Normalized Collector Current vs. Angular Displacement**



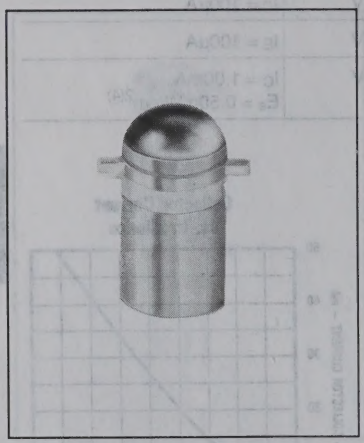

**Switching Time Test Circuit**

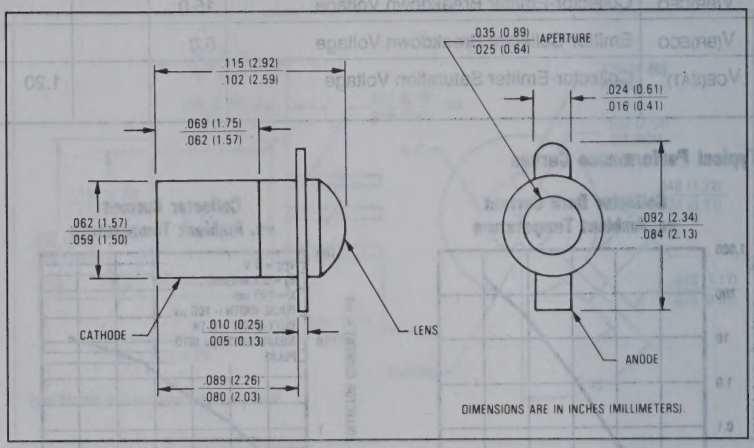

IF
VCC = 5 V
VOUT
RL
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until IC = 0.8 mA.

PHOTOSENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# PN Junction Silicon Photodiode
## Type OP900SL






### Features

- Narrow receiving angle
- Enhanced temperature range
- Ideal for direct mounting in PC boards
- Fast switching speed
- Mechanically and spectrally matched to the OP123 series emitters
- Linear response vs. irradiance

### Description

The OP900SL consists of a PN junction silicon photodiode mounted in a miniature, glass lensed, hermetically sealed "Pill" package. The lensing effect allows an acceptance half angle of 18° measured from the optical axis to the half power point.

### Replaces

OP900 series

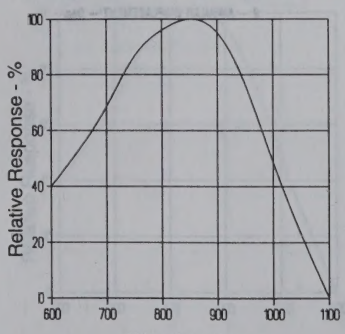
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100V |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Soldering Temperature (5 sec. with soldering iron) | 260°C(1) |
| Power Dissipation | 50mW(2) |

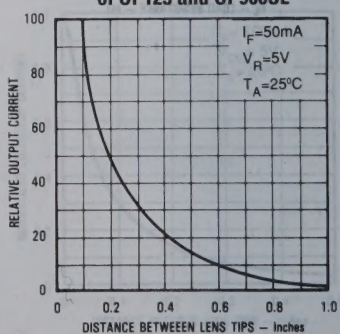
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 0.5mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.

### Typical Performance Curves

**Typical Spectral Response**




**Coupling Characteristics of OP123 and OP900SL**



OPTEK TECHNOLOGY, INC.

# PHOTOLOGIC™ SENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

Historically optoelectronic components such as phototransistors have been analog output devices. The designer had to design with an output current from the phototransistor generated by a given input bias circuit. The advent of integrated circuits and microprocessors has required the electronics world to turn digital. The sophisticated electronics today communicate by logic levels of 1's or O's. This means that the design engineer must now convert the analog light current of a phototransistor to a voltage level in order to communicate the sensing function to downstream processing electronics. This signal processing represents additional system cost in components and performance specification guardbanding which can be reflected in the unit pricing of the optoelectronic component or assembly.

Photologic™ discrete components utilize the best of the analog characteristics of optoelectronic components and the signal processing capabilities of linear integrated circuits and combines the two on one chip. The stable response and speed of a photodiode is used as an input to trigger the onboard integrated circuitry. The output of the optoelectronic component provides the designer a logic level output, instead of an analog current. This saves the end user processing circuitry system cost and affords performance specifications which are more easily designed and integrated into their application. In other words single switching to an on/off state, or dynamically switched signals, as in encoders, to multiple on/off states. The resulting output will be a high logic level (1), low logic level (0) or corresponding pulse train corresponding to the synamic triggering.

## Output Options

The Photologic™ family of photointegrated circuits is available with various output options. The output options for the buffer types (high logic level with light sensed) and inverter types (low logic level with light sensed) are a totem-pole output or open-collector output. These optional output configurations are offered to afford the design engineer the most versatility in addressing their system applications.

## Totem-Pole

A totem-pole configuration is very popular because of its inherent low output resistance for both a high and low output level. The low level output resistance will be the resistance at the collector of a saturated output transistor, typically in the order of 10 ohms. The high level output resistance in a totem-pole output is that of an emitter follower configuration. This is typically less than 100 ohms as compared to most collector load resistance values in the 1 kilo ohms range. The low output resistance of the totem pole configuration in both a high and low output level allows a more rapid charge and discharge of any load capacitance at the output. This results in comparable high to low and low to high transition times.

## Open-Collector

Even with the numerous advantages of the totem-pole configuration the open-collector output configuration has its place in the design world. With an open-collector output configuration the designer can configure one or more collector outputs into what is referred to as collector logic or wired logic. This is simply the ability to form a logic function using the available collector outputs. In this case the low output resistance for both the high and low output level of a totem-pole configuration is not desirable. The ability to design with wired logic can save on the number of logic gates required in a system design resulting in a cost savings.

## HYSTERESIS

The Photologic family incorporates a Schmitt trigger as part of the integrated circuit. The Schmitt trigger is a very useful circuit in steering the leading and trailing edges of a slowly rising or falling pulse. An inherent characteristic of a Schmitt trigger circuit is that a different input threshold level exists for a positive and negative signal. Hysteresis is the difference between the input thresholds of the Schmitt trigger.

The hysteresis, or threshold window, of the Schmitt trigger provides immunity to small input signal variations that are not desired on the output of the Photologic circuit. The larger the difference between the input thresholds the greater the immunity to noise or signal variations. The trade off is unfortunately speed or output response time.

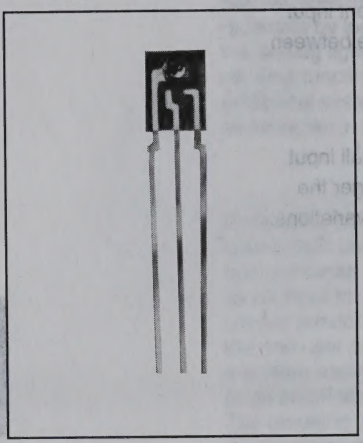


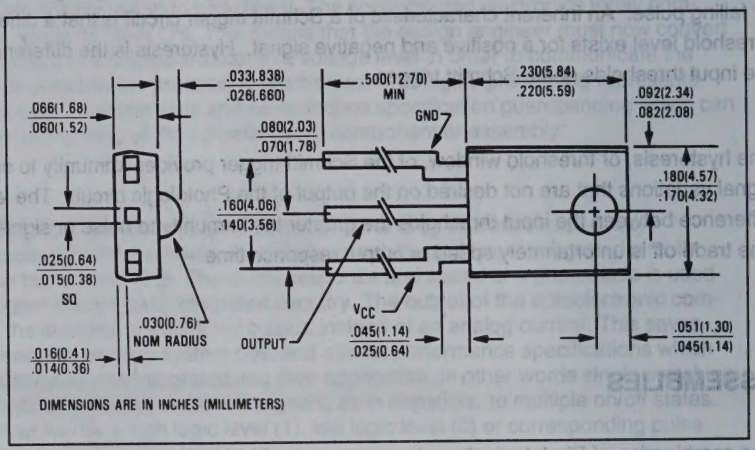
## ASSEMBLIES

The combination of Photologic discrete components and the large selection of standard housings, mechanical configurations and apertures provides the designer with literally hundreds of options available to address their application utilizing standard products. Optek offers the designer a value added assembly by adding a wide variety of connectors to the standard assemblies. Contact an Optek sales office for price and delivery of value added assemblies.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Photologic™ Plastic Sensors
## Types OPL550, OPL551 Series






### Features

- Four output options
- High noise immunity
- Direct TTL/LSTTL interface
- Low cost plastic side-looking package
- Mechanically and spectrally matched to OP140 and OP240 series LEDs
- Data rates to 250 kBaud

### Description

The OPL550, OPL550-OC, OPL551, and OPL551-OC contain a monolithic integrated circuit which incorporates a photodiode, a linear amplifier and a Schmitt trigger on a single silicon chip. The devices feature TTL/LSTTL compatible logic level output which can drive up to 8 TTL loads without additional circuitry. Also featured are medium speed data rates to 250 kBaud with typical rise and fall times of 25 nsec. The Schmitt trigger's hysteresis characteristics provide high immunity to noise on input and $V_{CC}$. The Photologic™ chip is encapsulated in a molded plastic package which has an integral lens for enhanced optical coupling. These devices are mechanically and spectrally matched to OP140 and OP240 infrared emitting diodes.

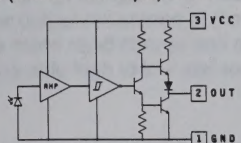
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (not to exceed 3 seconds) | +10.0V |
| Storage Temperature Range | -40°C to +100°C |
| Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 200mW(2) |
| Duration of Output Short to $V_{CC}$ or Ground (OPL550, OPL551) | 1.00 sec. |
| Duration of Output Short to $V_{CC}$ (OPL550-OC, OPL551-OC) | 1.00 sec. |
| Voltage at Output Lead (OPL550-OC, OPL551-OC) | 35V |
| Low Level Output Current | 16.0mA |
| High Level Output Current (OPL550, OPL551) | 1.00mA |
| Irradiance | 10mW/cm² |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 2.5 mW/°C above 25°C.
(3) Irradiance measurements are made with $\lambda_d$ = 935nm.

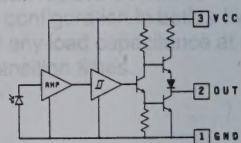
### Schematics

**OPL550** (Totem-Pole Output) Buffer



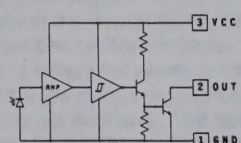

Light On - Output High

**OPL551** (Totem-Pole Output) Inverter



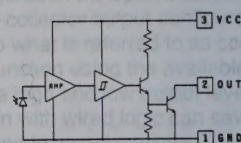

Light On - Output Low

**OPL550-0C** (Open-Collector Output) Buffer




Light On - Output High

**OPL551-0C** (Open-Collector Output) Inverter




Light On - Output Low

# Types OPL550, OPL551 Series

**Electrical Characteristics** (-40°C to +85°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Operating Supply Voltage | 4.5 | | 5.5 | V | |
| | Peak-to-Peak $V_{CC}$ Ripple Necessary to Cause False Triggering of Output | | 2.0 | | V | $V_{CC}$ = 5.0VDC<br>f = DC to 50 MHz |
| $E_eT(+)$ | Positive-Going Threshold Irradiance | | | | | |
| | OPL550, OPL550-OC, OPL551, OPL551-OC | .25 | | 2.40 | $mW/cm^2$ | $V_{CC}$ = 5.0V, $T_A$ = 25°C(3) |
| | OPL550A, OPL550-OCA, OPL551A, OPL551-OCA | .25 | | 1.40 | $mW/cm^2$ | $V_{CC}$ = 5.0V, $T_A$ = 25°C |
| | OPL550B, OPL550-OCB, OPL551B, OPL551-OCB | .65 | | 1.90 | $mW/cm^2$ | $V_{CC}$ = 5.0V, $T_A$ = 25°C |
| $E_eT(+)/E_eT(-)$ | Hysteresis Ratio | 1.50 | 2.0 | 2.5 | | |
| $I_{CC}$ | Supply Current | | 8.0 | 15.0 | mA | $V_{CC}$ = 5.5V, $E_e$ = 0or3mW/$cm^2$ |
| **OPL550** (Buffer, Totem-Pole) | | | | | | |
| $V_{OH}$ | High Level Output Voltage | 2.4 | 3.3 | | V | $V_{CC}$ = 4.5V, $I_{OH}$ = -800µA, $E_e$ = 3.0 mW/$cm^2$ |
| $V_{OL}$ | Low Level Output Voltage | | 0.25 | 0.40 | V | $V_{CC}$ = 4.5V, $I_{OL}$ = 12.8mA, $E_e$ = 0 |
| $I_{OS}$ | Short Circuit Output Current | -20 | -55 | -100 | mA | $V_{CC}$ = 5.5V, $E_e$ = 3.0mW/$cm^2$, Output = GND |
| **OPL550-OC** (Buffer, Open-Collector) | | | | | | |
| $I_{OH}$ | High Level Output Current | | 1.00 | 100 | µA | $V_{CC}$ = 4.5V, $V_{OH}$ = 30V, $E_e$ = 3.0mW/$cm^2$ |
| $V_{OL}$ | Low Level Output Voltage | | 0.25 | 0.40 | V | $V_{CC}$ = 4.5V, $I_{OL}$ = 12.8mA, $E_e$ = 0 |
| **OPL551** (Inverter, Totem-Pole) | | | | | | |
| $V_{OH}$ | High Level Output Voltage | 2.4 | 3.3 | | V | $V_{CC}$ = 4.5V, $I_{OH}$ = -800µA, $E_e$ = 0 |
| $V_{OL}$ | Low Level Output Voltage | | 0.25 | 0.40 | V | $V_{CC}$ = 4.5V, $I_{OL}$ = 12.8mA, $E_e$ = 3.0mW/$cm^2$ |
| $I_{OS}$ | Short Circuit Output Current | -20 | -55 | -100 | mA | $V_{CC}$ = 5.5V, $E_e$ = 0, Output = GND |
| **OPL551-OC** (Inverter, Open-Collector) | | | | | | |
| $I_{OH}$ | High Level Output Current | | 1.00 | 100 | µA | $V_{CC}$ = 4.5V, $V_{OH}$ = 30V, $E_e$ = 0 |
| $V_{OL}$ | Low Level Output Voltage | | 0.25 | 0.40 | V | $V_{CC}$ = 4.5V, $I_{OL}$ = 12.8mA, $E_e$ = 3.0mW/$cm^2$ |
| **OPL550,OPL551** | | | | | | |
| $t_r$, $t_f$ | Output Rise, Time Output Fall Time | | 25 | 70 | ns | $V_{CC}$ = 5.0V, $T_A$ = 25°C, Ee = 0 or 3.0mW/$cm^2$ |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 2.5 | 5.0 | µs | f = 10.0kHz, D.C. = 50%, $R_L$ = 8TTL Loads |
| **OPL550-OC, OPL551-OC** | | | | | | |
| $t_r$, $t_f$ | Output Rise, Time Output Fall Time | | 25 | 70 | ns | $V_{CC}$ = 5.0V, $T_A$ = 25°C, Ee = 0 or 3.0mW/$cm^2$ |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 2.5 | 5.0 | µs | f = 10.0kHz, D.C. = 50%, $R_L$ = 360Ω |

PHOTOLOGIC SENSORS

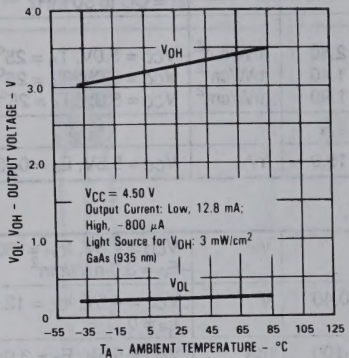
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

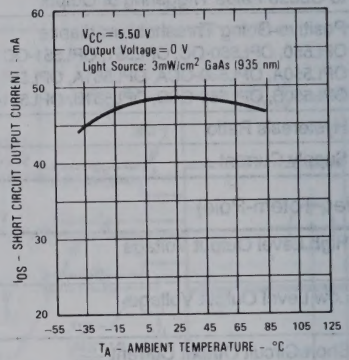
## Typical Performance Curves

### OPL550, OPL551

**Output Voltage vs. Ambient Temperature**

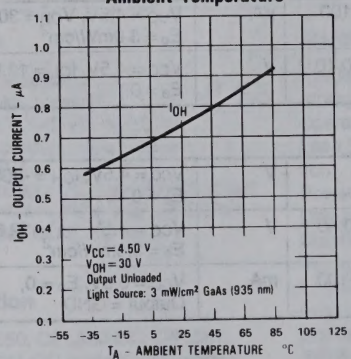



**Short Circuit Output Current vs. Ambient Temperature**

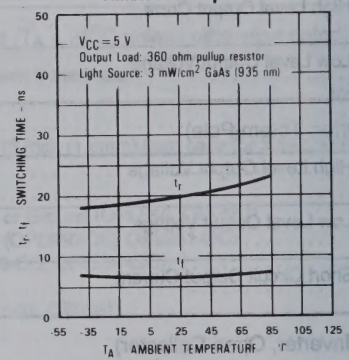

$V_{CC}$ = 5.50 V
Output Voltage = 0 V
Light Source: 3mW/cm² GaAs (935 nm)
$I_{OS}$ – SHORT CIRCUIT OUTPUT CURRENT – mA
60
50
40
30
20
−55 −35 −15 5 25 45 65 85 105 125
$T_A$ – AMBIENT TEMPERATURE – °C

### OPL550-OC, OPL551-OC

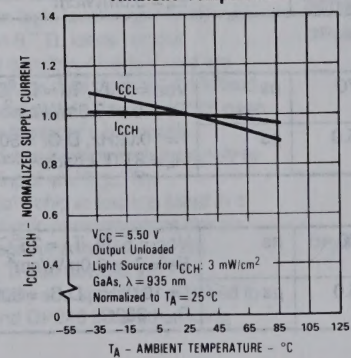
**Output Current (High) vs Ambient Temperature**



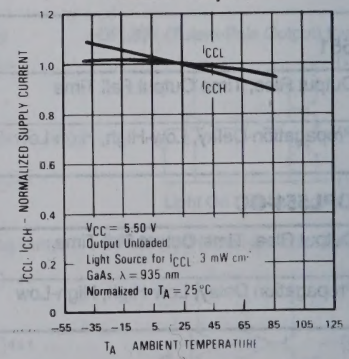

**Rise Time and Fall time vs Ambient Temperature**




**OPL550, OPL550-OC Normalized Supply Current vs Ambient Temperature**



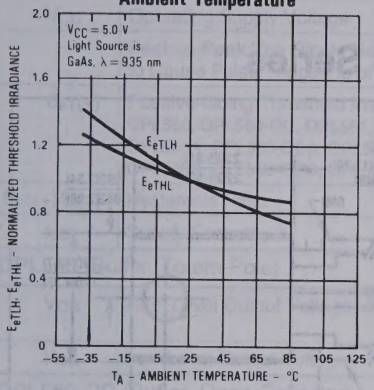

**OPL551, OPL551-OC Normalized Supply Current vs Ambient Temperature**



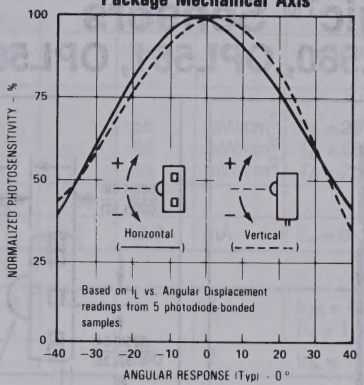

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

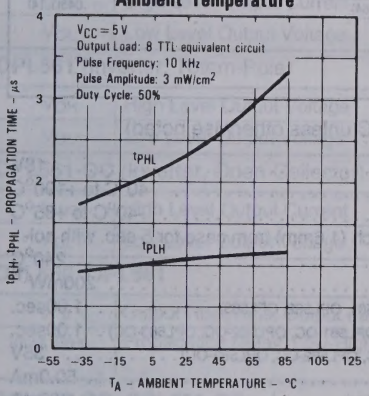
### Normalized Threshold Irradiance vs Ambient Temperature



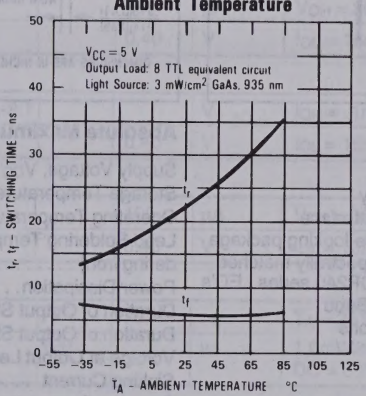

### Angular Displacement from Package Mechanical Axis


NORMALIZED PHOTOSENSITIVITY – %
Horizontal
Vertical
Based on $I_L$ vs. Angular Displacement readings from 5 photodiode-bonded samples.
ANGULAR RESPONSE (Typ) – 0°

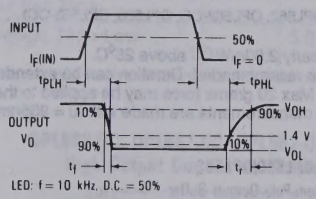
### Propagation Time vs Ambient Temperature


$V_{CC}$ = 5 V
Output Load: 8 TTL equivalent circuit
Pulse Frequency: 10 kHz
Pulse Amplitude: 3 mW/cm²
Duty Cycle: 50%
$t_{PHL}$
$t_{PLH}$
$t_{PLH}$, $t_{PHL}$ – PROPAGATION TIME – μs
$T_A$ – AMBIENT TEMPERATURE – °C

### Rise Time and Fall time vs Ambient Temperature

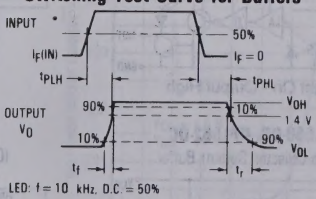

$V_{CC}$ = 5 V
Output Load: 8 TTL equivalent circuit
Light Source: 3 mW/cm² GaAs, 935 nm
$t_r$
$t_f$
$t_r$, $t_f$ – SWITCHING TIME – ns
$T_A$ – AMBIENT TEMPERATURE °C

### Switching Test Curve for Inverters




LED: f = 10 kHz, D.C. = 50%

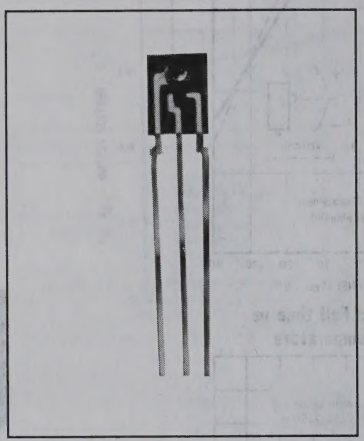
### Switching Test Curve for Buffers

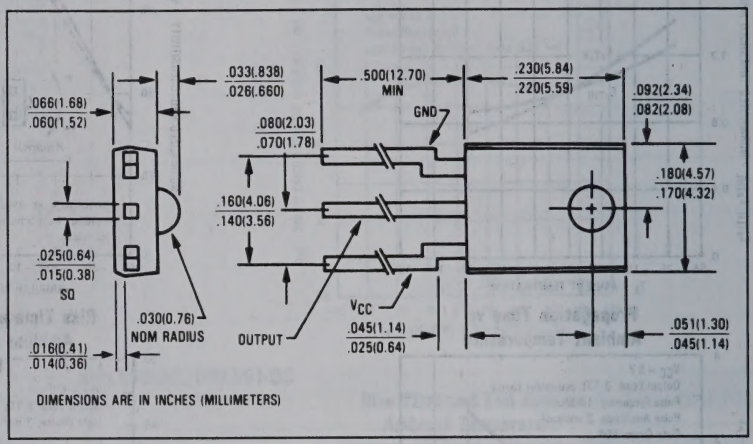



LED: f = 10 kHz, D.C. = 50%

PHOTOLOGIC SENSORS

# Photologic™ Sensors
## Types OPL560, OPL561, OPL562, OPL563 Series






### Features

- Four output options
- High noise immunity
- Direct TTL/LSTTL interface
- Low cost plastic side-looking package
- Mechanically and spectrally matched to the OP140 and OP240 series LED's
- Data rates to 200 kBaud
- Two sensitivity options

### Description

The OPL560, OPL560-OC, OPL561, OPL561-OC, OPL562, OPL562-OC, OPL563, and OPL563-OC contain a monolithic integrated circuit which incorporates a photodiode, a linear amplifier, voltage regulator, and a Schmitt trigger on a single silicon chip. The devices feature TTL/LSTTL compatible logic level output which can drive up to 10 TTL loads over supply voltages ranging from 4.5 V to 16 V. The Photologic™ chip is encapsulated in a molded plastic package which has an integral lens for enhanced optical coupling.

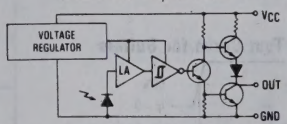
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 18V |
| Storage Temperature Range | -40°C to +100°C |
| Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature Range [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C |
| Power Dissipation | 200mW(1) |
| Duration of Output Short to $V_{CC}$ (OPL560, OPL561, OPL562, OPL563) | 1.00sec. |
| Duration of Output Short to $V_{CC}$ (OPL560-OC, OPL561-OC, OPL562-OC, OPL563-OC) | 1.00sec. |
| Voltage at Output Lead (OPL560-OC, OPL561-OC, OPL562-OC, OPL563-OC) | 35V |
| Sinking Current | 50.0mA |
| Sourcing Current (OPL560, OPL561, OPL562, OPL563) | 10.0mA |
| Irradiance (OPL560, OPL560-OC, OPL561, OPL561-OC) | 9mW/cm$^2$ |
| Irradiance (OPL562, OPL562-OC, OPL563, OPL563-OC) | 3mW/cm$^2$ |

**Notes:**
(1) Derate linearly 2.50mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. maximum when flow soldering. Max 20 grams force may be applied to the leads when soldering.
(3) Irradiance measurements are made with λi = 935nm.

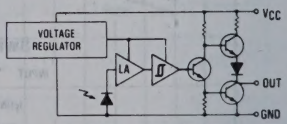
**Schematics**

**OPL560/OPL562**
(Totem-Pole Output) Buffer



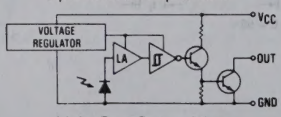

Light On - Output High

**OPL561/OPL563**
(Totem-Pole Output) Inverter



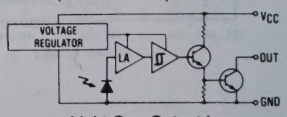

Light On - Output Low

**OPL560-OC, OPL562-OC**
(Open-Collector Output) Buffer




Light On - Output High

**OPL561-OC, OPL563-OC**
(Open-Collector Output) Inverter




Light On - Output Low

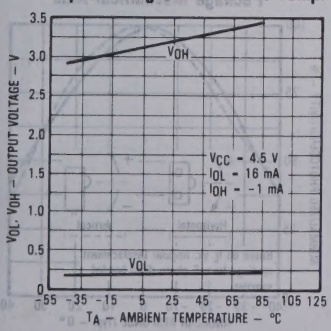
# Types OPL560, OPL561 Series

**Electrical Characteristics** (-40°C to +85°C unless otherwise noted) $V_{CC}$ = 4.5 to 16.0 V

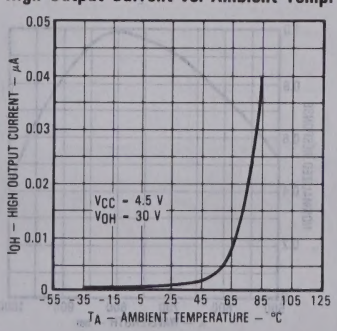
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Operating Supply Voltage | 4.5 | | 16.0 | V | |
| | Peak-to-Peak $V_{CC}$ Ripple Necessary to Cause False Triggering of Output | | | 2 | V | f = DC to 50 MHz |
| $E_{eT}(+)$ | Positive-Going Threshold Irradiance[3] | | | | | |
| | OPL560, OPL560-OC, OPL561, OPL561-OC | .09 | | .55 | mW/cm² | $T_A$ = 25°C |
| | OPL560A, OPL560-OCA, OPL561A, OPL561-OCA | .09 | | .36 | mW/cm² | $T_A$ = 25°C |
| | OPL560B, OPL560-OCB, OPL561B, OPL561-OCB | .18 | | .55 | mW/cm² | $T_A$ = 25°C |
| $E_{eT}(+)/E_{eT}(-)$ | Hysteresis Ratio | 1.20 | 1.55 | 2.00 | | |
| $I_{CC}$ | Supply Current | | 8.0 | 12.0 | mA | $E_e$ = 0 or 1 mW/cm² |
| **OPL560** (Buffer, Totem-Pole) | | | | | | |
| $V_{OH}$ | High Level Output Voltage | $V_{CC}$-2.1 | | | V | $I_{OH}$ = -1.0μA, $E_e$ = 1 mW/cm² |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = 0 |
| **OPL560-OC** (Buffer, Open-Collector) | | | | | | |
| $I_{OH}$ | High Level Output Current | | | 100 | μA | $V_{OH}$ = 30V, $E_e$ = 1.0mW/cm² |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = 0 |
| **OPL561** (Inverter, Totem-Pole) | | | | | | |
| $V_{OH}$ | High Level Output Voltage | $V_{CC}$-2.1 | | | V | $I_{OH}$ = -1mA, $E_e$ = 0 |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = 1.0mW/cm² |
| **OPL561-OC** (Inverter, Open-Collector) | | | | | | |
| $I_{OH}$ | High Level Output Current | | | 100 | μA | $V_{OH}$ = 30V, $E_e$ = 0 |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = 1.0mW/cm² |
| **OPL560, OPL561** | | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | | 70 | ns | $T_A$ = 25°C, $E_e$ = 0 or 1.0mW/cm², f = 10.0kHz DC = 50%, $R_L$ = 10TTL Loads |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 5.0 | | μs | |
| **OPL560-OC, OPL561-OC** | | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | | 100 | ns | $T_A$ = 25°C, $E_e$ = 0 or 1.0mW/cm², f = 10.0kHz, DC = 50%, $R_L$ = 300Ω |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 5.0 | | μs | |

## Typical Performance Curves

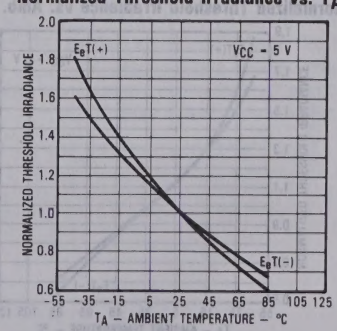
**OPL560, OPL561, OPL562, OPL563**
**Output Voltage vs. Ambient Temp.**




**OPL560-OC, OPL561-OC, OPL562-OC, OPL563-OC**
**High Output Current vs. Ambient Temp.**




**OPL560, OPL560-OC, OPL561, OPL561-OC**
**Normalized Threshold Irradiance vs. $T_A$**




PHOTOLOGIC SENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Types OPL562, OPL563 Series

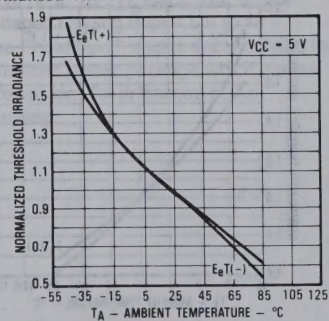
OPTEK

**Electrical Characteristics** (-40°C to +85°C unless otherwise noted) $V_{CC}$ = 4.5 to 16.0 V

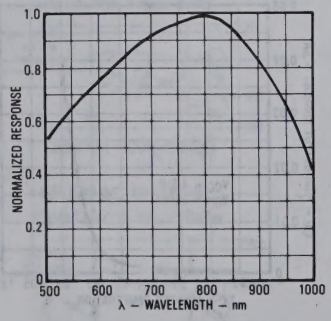
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Operating Supply Voltage | 4.5 | | 16.0 | V | |
| | Peak-to-Peak $V_{CC}$ Ripple Necessary to Cause False Triggering of Output | | | 2 | V | f = DC to 50 MHz |
| $E_{eT}(+)$ | Positive-Going Threshold Irradiance[3] | | | | | |
| | OPL562, OPL562-OC, OPL563, OPL563-OC | .025 | | .230 | mW/cm$^2$ | $T_A$ = 25°C |
| | OPL562A, OPL562-OCA, OPL563A, OPL563-OCA | .025 | | .140 | mW/cm$^2$ | $T_A$ = 25°C |
| | OPL562B, OPL562-OCB, OPL563B, OPL563-OCB | .070 | | .230 | mW/cm$^2$ | $T_A$ = 25°C |
| $E_{eT}(+)/E_{eT}(-)$ | Hysteresis Ratio | 1.20 | 1.55 | 2.00 | | |
| $I_{CC}$ | Supply Current | | 8.0 | 12.0 | mA | $E_e$ = 0 or .3mW/cm$^2$ |
| **OPL562** (Buffer, Totem-Pole) | | | | | | |
| $V_{OH}$ | High Level Output Voltage | $V_{CC}$-2.1 | | | V | $I_{OH}$ = -1.0μA, $E_e$ = .3mW/cm$^2$ |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = 0 |
| **OPL562-OC** (Buffer, Open-Collector) | | | | | | |
| $I_{OH}$ | High Level Output Current | | | 100 | μA | $V_{OH}$ = 30V, $E_e$ = .3mW/cm$^2$ |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = 0 |
| **OPL563** (Inverter, Totem-Pole) | | | | | | |
| $V_{OH}$ | High Level Output Voltage | $V_{CC}$-2.1 | | | V | $I_{OH}$ = -1mA, $E_e$ = 0 |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = .3mW/cm$^2$ |
| **OPL563-OC** (Inverter, Open-Collector) | | | | | | |
| $I_{OH}$ | High Level Output Current | | | 100 | μA | $V_{OH}$ = 30V, $E_e$ = 0 |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = .3mW/cm$^2$ |
| **OPL562, OPL563** | | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | | 70 | ns | $T_A$ = 25°C, $E_e$ = 0 or .3mW/cm$^2$, f = 10.0kHz DC = 50%, $R_L$ = 10TTL Loads |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 6.0 | | μs | |
| **OPL562-OC, OPL563-OC** | | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | | 100 | ns | $T_A$ = 25°C, $E_e$ = 0 or .3mW/cm$^2$, f = 10.0kHz, DC = 50%, $R_L$ = 300Ω |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 6.0 | | μs | |

## Typical Performance Curves

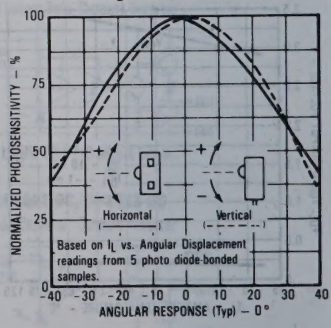
**OPL562, OPL562-OC, OPL563, OPL563-OC Normalized Threshold Irradiance vs. Amb. Temp.**




**Normalized Spectral Response**



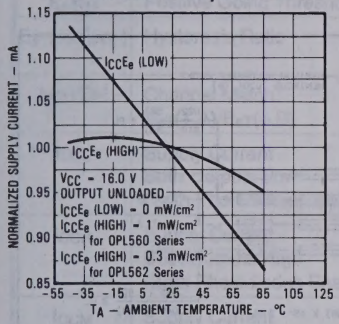

**Angular Displacement from Package Mechanical Axis**



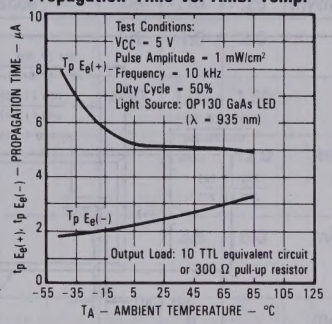
# Types OPL562, OPL563 Series

## Typical Performance Curves

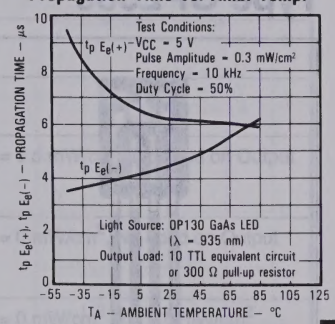
### Normalized Supply Current vs. Ambient Temperature



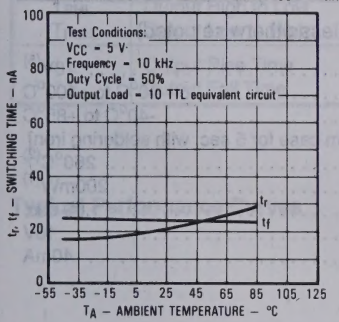

### OPL560, OPL560-OC, OPL561, OPL561-OC Propagation Time vs. Amb. Temp.


tp Ee(+), tp Ee(–) – PROPAGATION TIME – µs
10
8
6
4
2
0
Test Conditions:
VCC = 5 V
Pulse Amplitude = 1 mW/cm²
Frequency = 10 kHz
Duty Cycle = 50%
Light Source: OP130 GaAs LED (λ = 935 nm)
Tp Ee(+)
Tp Ee(–)
Output Load: 10 TTL equivalent circuit or 300 Ω pull-up resistor
-55 -35 -15 5 25 45 65 85 105 125
TA – AMBIENT TEMPERATURE – °C

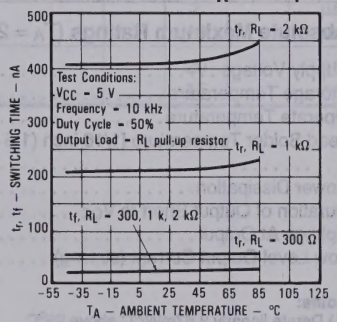
### OPL562, OPL562-OC, OPL563, OPL563-OC Propagation Time vs. Amb. Temp.


tp Ee(+), tp Ee(–) – PROPAGATION TIME – µs
10
8
6
4
2
0
Test Conditions:
VCC = 5 V
Pulse Amplitude = 0.3 mW/cm²
Frequency = 10 kHz
Duty Cycle = 50%
tp Ee(+)
tp Ee(–)
Light Source: OP130 GaAs LED (λ = 935 nm)
Output Load: 10 TTL equivalent circuit or 300 Ω pull-up resistor
-55 -35 -15 5 25 45 65 85 105 125
TA – AMBIENT TEMPERATURE – °C

### OPL560, OPL561, OPL562, OPL563 Rise Time & Fall Time vs. $T_A$

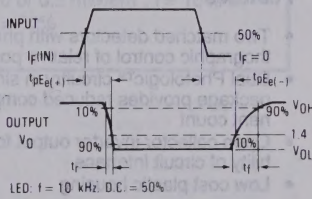



### OPL560-OC, OPL561-OC, OPL562-OC, OPL563-OC Rise Time & Fall Time vs. $T_A$ vs. Output Load

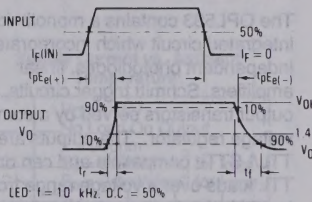

tr, tf – SWITCHING TIME – nA
500
400
300
200
100
0
Test Conditions:
VCC = 5 V
Frequency = 10 kHz
Duty Cycle = 50%
Output Load = RL pull-up resistor
tr, RL = 2 kΩ
tr, RL = 1 kΩ
tf, RL = 300, 1 k, 2 kΩ
tr, RL = 300 Ω
-55 -35 -15 5 25 45 65 85 105 125
TA – AMBIENT TEMPERATURE – °C

### Switching Test Curves

#### Switching Test Curve for Inverters



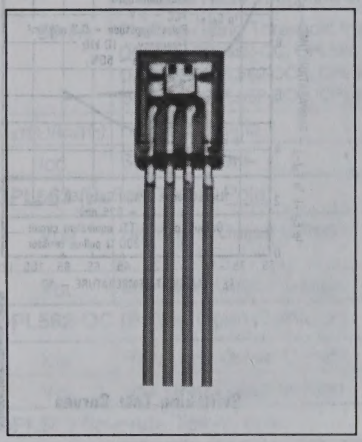

#### Switching Test Curve for Buffers

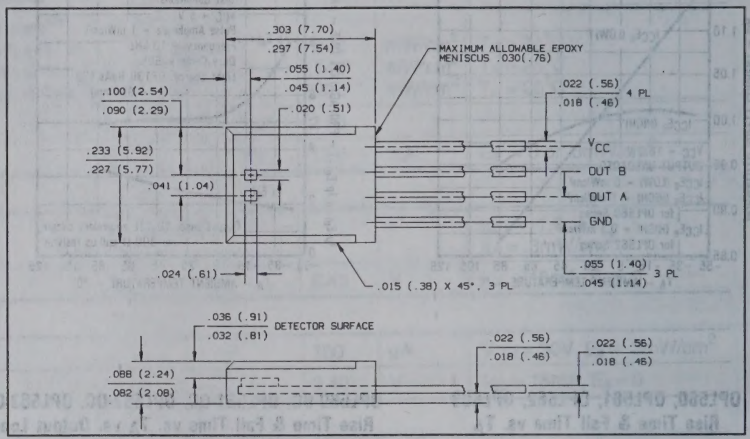



PHOTOLOGIC SENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Dual Channel Photologic™ Encoder Detector
## Type OPL583






### Features

- Two matched detectors with photolithographic control of relative position
- Dual Photologic™ circuitry in single package provides reduced component count
- Open collector inverter output for flexibility of circuit interface
- Low cost plastic housing

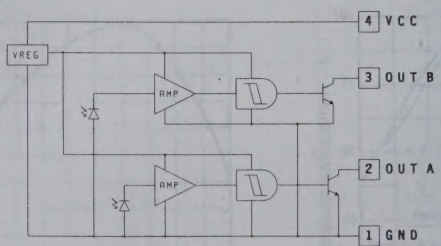
### Description

The OPL583 contains a monolithic integrated circuit which incorporates two independent photodiodes, linear amplifiers, Schmitt trigger circuits, and output transistors served by a common voltage regulator. The outputs are TTL/LSTTL compatible and can drive 8 TTL loads over a voltage range from 4.5 to 16 V. Applications include linear and rotary encoders with resolutions determined by external apertures. The fixed relative position of the two photodiodes and the matched characteristics of the two channels allow considerable design flexibility.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage | 18V(5) |
| Storage Temperature | -40°C to +100°C |
| Operate Temperature | -40°C to +85°C |
| Lead Solder Temperature [1/16 inch (1.6 mm) from case for 5 sec. with soldering iron] | 260°C(2) |
| Power Dissipation | 200mW(1) |
| Duration of Output Short to $V_{CC}$ | 1.00 sec. |
| Voltage At Output | 18V |
| Low Level Output Current (sinking) | 40mA |

**Notes:**
(1) Derate linearly 2.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering. Max 20 grams force may be applied to leads when flow soldering.
(3) A .01 µF capacitor should be used across the $V_{CC}$ and GND leads to stabilize the power supply line.
(4) Irradiance measurements are made with λ = 940 nm.
(5) Derate linearly 0.37V/°C above 58°C.



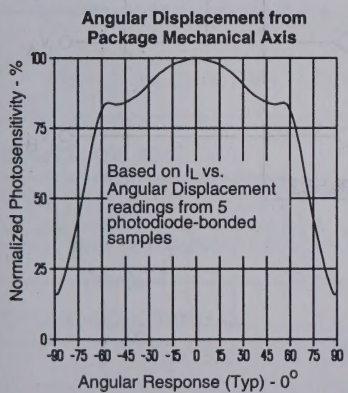
# Type OPL583

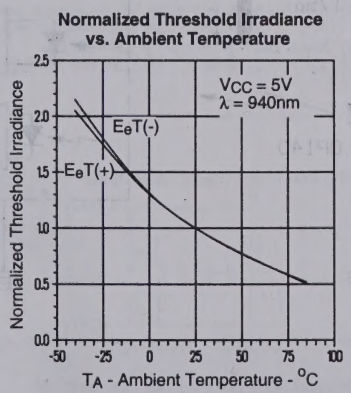
**Electrical Characteristics** ($T_A$ = 25°C, $V_{CC}$ = 4.5 V - 16.0 V unless otherwise noted)

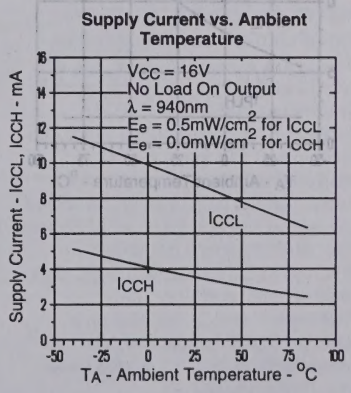
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Operating Supply Voltage[3] | 4.5 | | 16 | V | |
| $E_{eT(+)}$ | Positive Going Threshold Irradiance[4] | .05 | .10 | .25 | mW/cm$^2$ | |
| $E_{eT(+)}/E_{eT(-)}$ | Hysteresis Ratio | 1.1 | 1.5 | 2.0 | | |
| MATCH | Channel Match<br>$E_{eT(+,A)}/E_{eT(+,B)}$ | 0.67 | 1.00 | 1.50 | | |
| $I_{CCL}$ | Supply Current<br>Both Outputs Low<br>(Both Photodiodes Irradiated) | | 8.5 | 12.0 | mA | $E_e$ = 0.5 mW/cm$^2$, No Load on Output |
| $I_{CCH}$ | Supply Current<br>Both Outputs High<br>(Both Photodiodes Shaded) | | 3.5 | 6.0 | mA | $E_e$ = 0 mW/cm$^2$, No Load on Output |
| $I_{CCM}$ | Supply Current<br>Mixed Output States (One High, One Low) | | 6 | | mA | $E_e$ = 0 mW/cm$^2$ and 0.5 mW/cm$^2$ |
| $I_{OH}$ | High Level Output Current | | 1.0 | 30.0 | µA | $E_e$ = 0 mW/cm$^2$, $V_{OH}$ = 16 V |
| $V_{OL}$ | Low Level Output Voltage | | 0.21 | 0.40 | V | $E_e$ = 0.5 mW/cm$^2$, $I_{OL}$ = 12.8 mA |
| | Propagation Delay | | | | | $V_{CC}$ = 5 V, $R_L$ = 360 Ω<br>$E_e$ = 0 or 0.5 mW/cm$^2$, f = 10 kHz,<br>D.C. = 50% |
| $T_{PHL}$ | Output High to Low | | 2 | | µs | |
| $T_{PLH}$ | Output Low to High | | 10 | | µs | |
| $t_r$ | Output Rise Time | | 20 | | ns | |
| $t_f$ | Output Fall Time | | 15 | | ns | |

PHOTOLOGIC SENSORS

## Typical Performance Curves


Angular Displacement from Package Mechanical Axis
Normalized Photosensitivity - %
100
75
50
25
0
Based on $I_L$ vs. Angular Displacement readings from 5 photodiode-bonded samples
-90 -75 -60 -45 -30 -15 0 15 30 45 60 75 90
Angular Response (Typ) - 0°

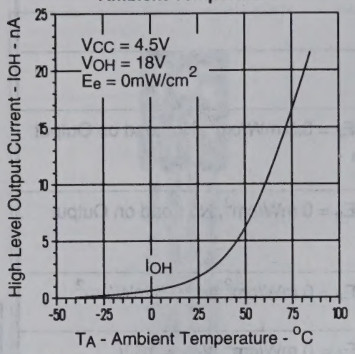


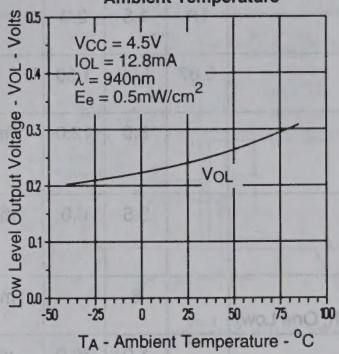

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

## Typical Performance Curves

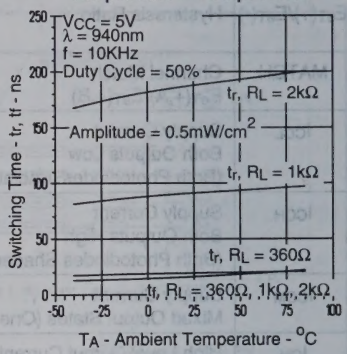
**High Level Output Current vs. Ambient Temperature**



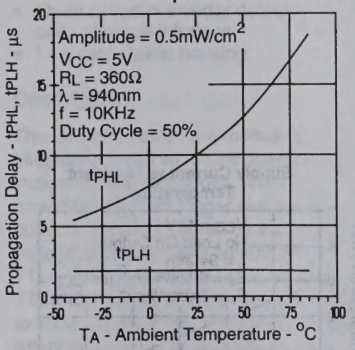

**Low Level Output Voltage vs. Ambient Temperature**



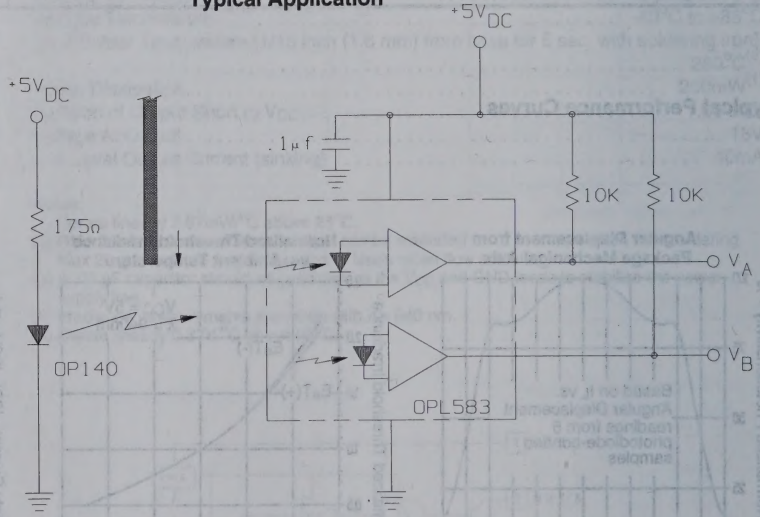

**Rise, Fall Time vs. Ambient Temperature vs. Output Load**

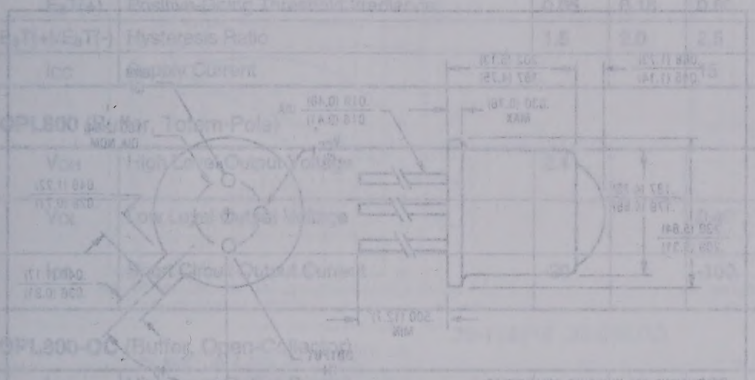

VCC = 5V
λ = 940nm
f = 10KHz
Duty Cycle = 50%
tr, RL = 2kΩ
Amplitude = 0.5mW/cm2
tr, RL = 1kΩ
tr, RL = 360Ω
tf, RL = 360Ω, 1kΩ, 2kΩ
Switching Time - tr, tf - ns
TA - Ambient Temperature - °C

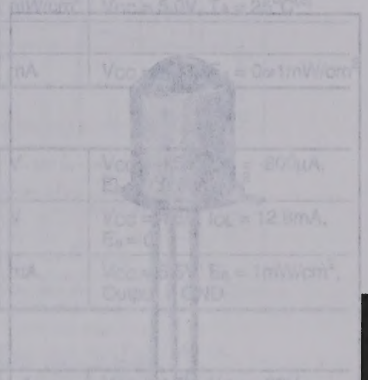
**Propagation Delay vs. Ambient Temperature**



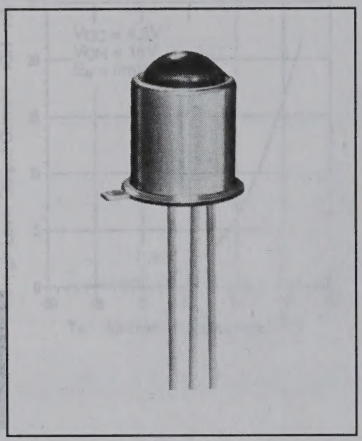

**Typical Application**

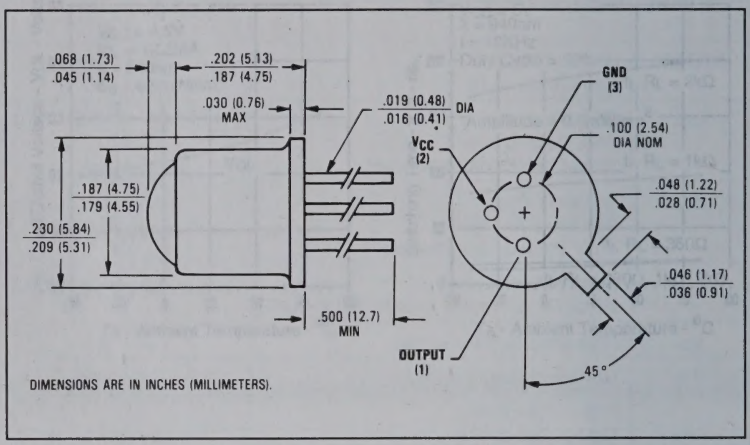






# Photologic™ Hermetic Sensors
## Types OPL800, OPL801 Series






### Features

- Four output options
- High noise immunity
- Direct TTL/LSTTL interface
- TO-18 hermetic package
- Mechanically and spectrally matched to OP130 and OP231 series LEDs
- Data rates to 250 kBaud
- TX-TXV process available (see Hi-Rel section)

### Description

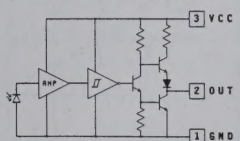
The OPL800, OPL800-OC, OPL801, and OPL801-OC each incorporate a photodiode, a linear amplifier, and a Schmitt trigger on a single silicon chip. The devices feature TTL/LSTTL compatible logic level output which can drive up to 8 TTL loads without additional circuitry. Also featured are medium speed data rates to 250 kBaud with typical rise and fall times of 25 nsec. The Schmitt trigger's hysteresis characteristics provide high immunity to noise on input and $V_{CC}$. The Photologic™ chip is mounted on a standard TO-18 header which is hermetically sealed in a lensed metal can. These devices are mechanically and spectrally matched to OP130 and OP230 infrared emitting diodes.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (not to exceed 3 seconds) | +10.0V |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +110°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 120mW(2) |
| Duration of Output Short to $V_{CC}$ or Ground (OPL800, OPL801) | 1.00 sec. |
| Duration of Output Short to $V_{CC}$ (OPL800-OC, OPL801-OC) | 1.00 sec. |
| Voltage at Output Lead (OPL800-OC, OPL801-OC) | 35V |
| Irradiance | 3mW/cm$^2$ |

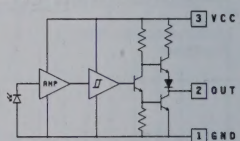
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 3.4 mW/°C above 90°C.
(3) Light measurements are made with λ = 935nm.

**OPL800** (Totem-Pole Output) Buffer



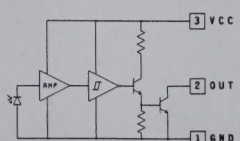

Light On - Output High

**OPL801** (Totem-Pole Output) Inverter



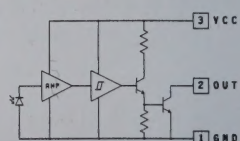

Light On - Output Low

**OPL800-0C** (Open-Collector Output) Buffer




Light On - Output High

**OPL801-0C** (Open-Collector Output) Inverter




Light On - Output Low

# Types OPL800, OPL801 Series

**Electrical Characteristics** (-40°C to +100°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Operating Supply Voltage | 4.5 | | 5.5 | V | |
| | Peak-to-Peak $V_{CC}$ Ripple Necessary to Cause False Triggering of Output | | 2.0 | | V | $V_{CC}$ = 5.0VDC f = DC to 50 MHz |
| $E_eT(+)$ | Positive-Going Threshold Irradiance | 0.05 | 0.18 | 0.60 | mW/cm$^2$ | $V_{CC}$ = 5.0V, $T_A$ = 25°C(3) |
| $E_eT(+)/E_eT(-)$ | Hysteresis Ratio | 1.5 | 2.0 | 2.5 | | |
| $I_{CC}$ | Supply Current | | | 15 | mA | $V_{CC}$ = 5.5V, $E_e$ = 0or1mW/cm$^2$ |
| **OPL800** (Buffer, Totem-Pole) | | | | | | |
| $V_{OH}$ | High Level Output Voltage | 2.4 | | | V | $V_{CC}$ = 4.5V, $I_{OH}$ = -800µA, $E_e$ = 1.0 mW/cm$^2$ |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $V_{CC}$ = 4.5V, $I_{OL}$ = 12.8mA, $E_e$ = 0 |
| $I_{OS}$ | Short Circuit Output Current | -20 | | -100 | mA | $V_{CC}$ = 5.5V, $E_e$ = 1mW/cm$^2$, Output = GND |
| **OPL800-OC** (Buffer, Open-Collector) | | | | | | |
| $I_{OH}$ | High Level Output Current | | | 100 | µA | $V_{CC}$ = 4.5V, $V_{OH}$ = 30V, $E_e$ = 2.0mW/cm$^2$ |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $V_{CC}$ = 4.5V, $I_{OL}$ = 12.8mA, $E_e$ = 0 |
| **OPL801** (Inverter, Totem-Pole) | | | | | | |
| $V_{OH}$ | High Level Output Voltage | 2.4 | | | V | $V_{CC}$ = 4.5V, $I_{OH}$ = -800µA, $E_e$ = 0 |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $V_{CC}$ = 4.5V, $I_{OL}$ = 12.8mA, $E_e$ = 1.0mW/cm$^2$ |
| $I_{OS}$ | Short Circuit Output Current | -20 | | -100 | mA | $V_{CC}$ = 5.5V, $E_e$ = 0, Output = GND |
| **OPL801-OC** (Inverter, Open-Collector) | | | | | | |
| $I_{OH}$ | High Level Output Current | | | 100 | µA | $V_{CC}$ = 4.5V, $V_{OH}$ = 30V, $E_e$ = 0 |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $V_{CC}$ = 4.5V, $I_{OL}$ = 12.8mA, $E_e$ = 1.0mW/cm$^2$ |
| **OPL800, OPL801** | | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | 70 | | ns | $V_{CC}$ = 5.0V, $T_A$ = 25°C, $E_e$ = 0 or 1.00mW/cm$^2$ |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 5.0 | | µs | f = 10.0kHz, D.C. = 50%, $R_L$ = 8TTL Loads |
| **OPL800-OC, OPL801-OC** | | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | 70 | | ns | $V_{CC}$ = 5.0V, $T_A$ = 25°C, $E_e$ = 0 or 1.00mW/cm$^2$ |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 5.0 | | µs | f = 10.0kHz, D.C. = 50%, $R_L$ = 360Ω |

PHOTOLOGIC SENSORS

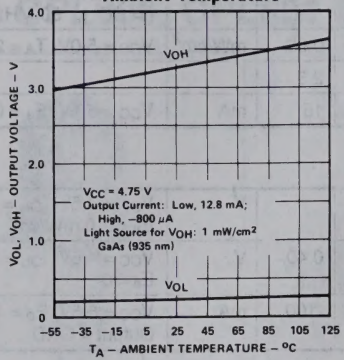
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

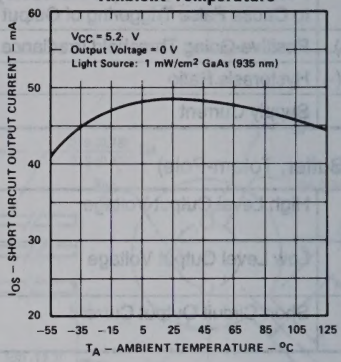
## Typical Performance Curves

### OPL800, OPL801

**Output Voltage vs. Ambient Temperature**

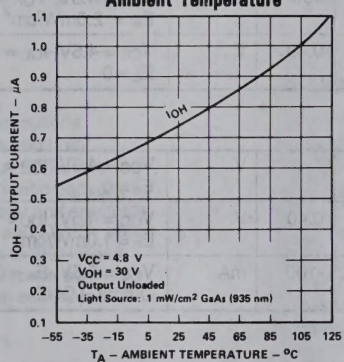



**Short Circuit Output Current vs. Ambient Temperature**

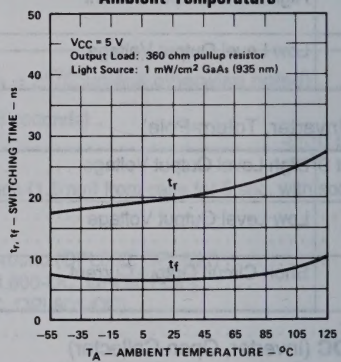

60
50
40
30
20
VCC = 5.2 V
Output Voltage = 0 V
Light Source: 1 mW/cm² GaAs (935 nm)
IOS – SHORT CIRCUIT OUTPUT CURRENT – mA
−55 −35 −15 5 25 45 65 85 105 125
TA – AMBIENT TEMPERATURE – °C

### OPL800-OC, OPL801-OC

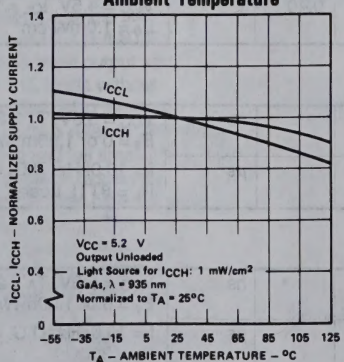
**Output Current (High) vs. Ambient Temperature**



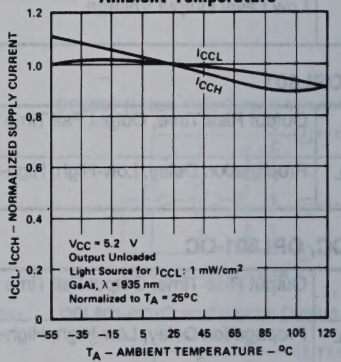

**Rise Time and Fall Time vs. Ambient Temperature**




**OPL800, OPL800-OC Normalized Supply Current vs. Ambient Temperature**

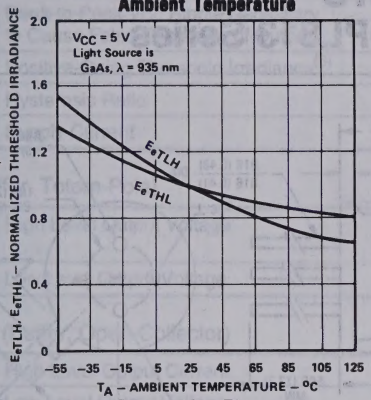



**OPL801, OPL801-OC Normalized Supply Current vs. Ambient Temperature**

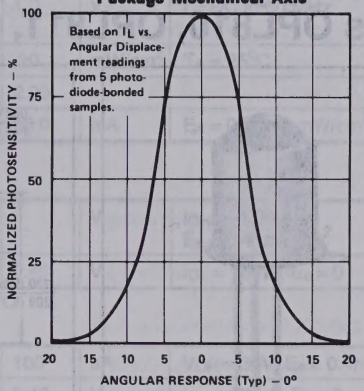


## Typical Performance Curves

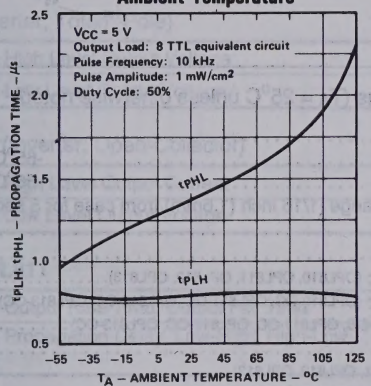
**Normalized Threshold Irradiance vs. Ambient Temperature**



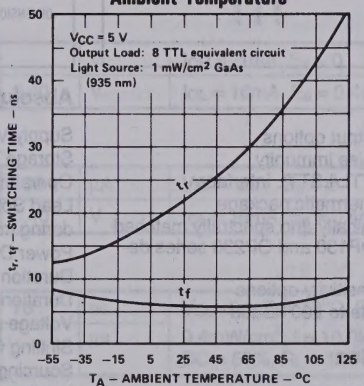

**Angular Displacement from Package Mechanical Axis**



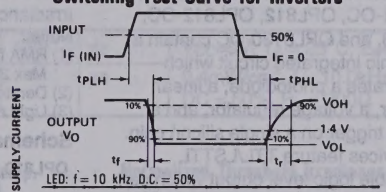

**Propagation Time vs. Ambient Temperature**



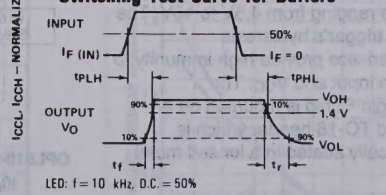

**Rise Time and Fall Time vs. Ambient Temperature**




**Switching Test Curve for Inverters**



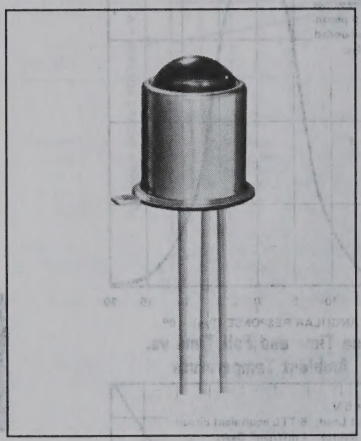

**Switching Test Curve for Buffers**

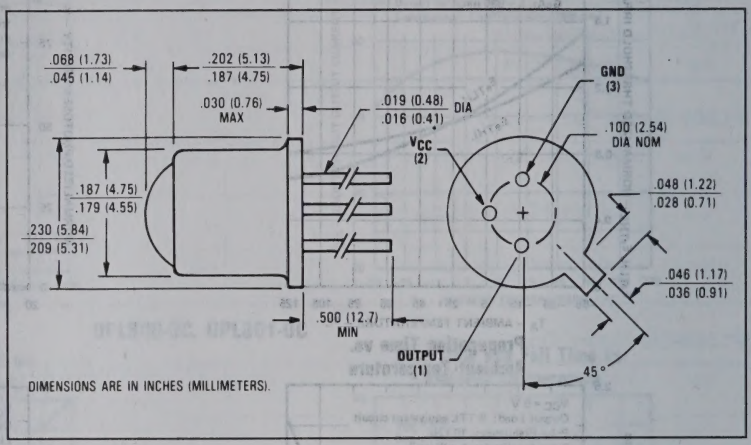



ICCL, ICCH – NORMALIZED SUPPLY CURRENT

PHOTOLOGIC SENSORS

# Photologic™ Hermetic Sensors
## Types OPL810, OPL811, OPL812, OPL813 Series






### Features

- Four output options
- High noise immunity
- Direct TTL/LSTTL interface
- TO-18 hermetic package
- Mechanically and spectrally matched to the OP130 and OP230 series devices
- Two sensitivity options
- Data rate to 200 kBaud

### Description

The OPL810, OPL810-OC, OPL811, OPL811-OC, OPL812, OPL812-OC, OPL813, and OPL8130-OC contain a monolithic integrated circuit which incorporates a photodiode, a linear amplifier, a voltage regulator, and a Schmitt trigger on a single silicon chip. The devices feature TTL/LSTTL compatible logic level output which can drive up to 10 TTL loads over supply voltages ranging from 4.5V to 16V. The Schmitt trigger's hysteresis characteristics provide high immunity to noise on input and $V_{CC}$. The Photologic™ chip is mounted on a standard TO-18 header which is hermetically sealed in a lensed metal can.

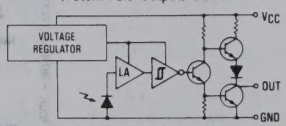
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 18V |
| Storage Temperature Range | -65°C to +125°C |
| Operating Temperature Range | -55°C to +105°C |
| Lead Soldering Temperature Range [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Power Dissipation | 250mW(2) |
| Duration of Output Short to $V_{CC}$ (OPL810, OPL811, OPL812, OPL813) | 1sec. |
| Duration of Output Short to $V_{CC}$ (OPL810-OC, OPL811-OC, OPL812-OC, OPL813-OC) | 1sec. |
| Voltage at Output Lead (OPL810-OC, OPL811-OC, OPL812-OC, OPL813-OC) | 35V |
| Sinking Current | 50mA |
| Sourcing Current (OPL810, OPL811, OPL812, OPL813) | 10mA |
| Irradiance (OPL810, OPL810-OC, OPL811, OPL811-OC) | 2mW/cm² |
| Irradiance (OPL812, OPL812-OC, OPL813, OPL813-OC) | 1mW/cm² |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 2.5mW/°C above 25°C.
(3) Light measurements are made with λi = 935nm.

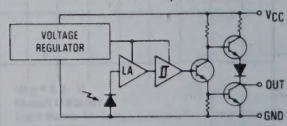
### Schematics

**OPL810, OPL812**
(Totem-Pole Output) Buffer



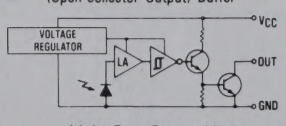

Light On - Output High

**OPL811, OPL813**
(Totem-Pole Output) Inverter



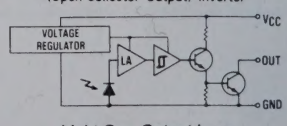

Light On - Output Low

**OPL810-OC, OPL812-OC**
(Open-Collector Output) Buffer




Light On - Output High

**OPL811-OC, OPL813-OC**
(Open-Collector Output) Inverter




Light On - Output Low

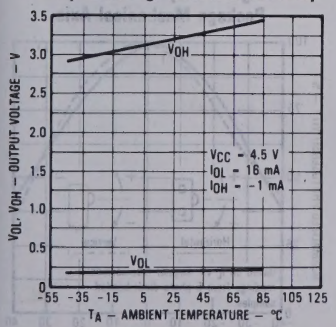
# Types OPL810, OPL811 Series

**Electrical Characteristics** (-40°C to +100°C unless otherwise noted) $V_{CC}$ = 4.5 to 16.0 V

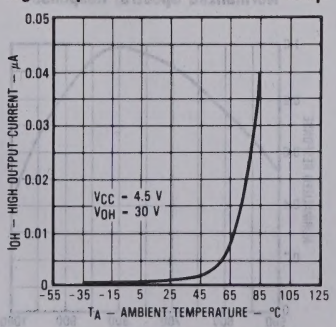
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Operating Supply Voltage | 4.5 | | 16.0 | V | |
| | Peak-to-Peak $V_{CC}$ Ripple Necessary to Cause False Triggering of Output | | | 1.0 | V | f = DC to 50 MHz |
| $E_{eT}(+)$ | Positive-Going Threshold Irradiance(3) | .015 | .06 | .20 | mW/cm$^2$ | $T_A$ = 25°C |
| $E_{eT}(+)/E_{eT}(-)$ | Hysteresis Ratio | 1.20 | 1.55 | 2.00 | | |
| $I_{CC}$ | Supply Current | | | 15.0 | mA | $E_e$ = 0 or 0.4 mW/cm$^2$ |
| **OPL810** (Buffer, Totem-Pole) | | | | | | |
| $V_{OH}$ | High Level Output Voltage | $V_{CC}$-2.1 | | | V | $I_{OH}$ = -1.0mA, $E_e$ = 0.4 mW/cm$^2$ |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = 0 |
| **OPL810-OC** (Buffer, Open-Collector) | | | | | | |
| $I_{OH}$ | High Level Output Current | | | 100 | µA | $V_{OH}$ = 30V, $E_e$ = 0.4mW/cm$^2$ |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = 0 |
| **OPL811** (Inverter, Totem-Pole) | | | | | | |
| $V_{OH}$ | High Level Output Voltage | $V_{CC}$-2.1 | | | V | $I_{OH}$ = -1mA, $E_e$ = 0 |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = 0.4mW/cm$^2$ |
| **OPL811-OC** (Inverter, Open-Collector) | | | | | | |
| $I_{OH}$ | High Level Output Current | | | 100 | µA | $V_{OH}$ = 30V, $E_e$ = 0 |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = 0.4mW/cm$^2$ |
| **OPL810, OPL811** | | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | | 70 | ns | $V_{CC}$=5V, $T_A$= 25°C, $E_e$= 0 or |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 5.0 | | µs | 0.4mW/cm$^2$, f = 10.0kHz DC = 50%, $R_L$ = 10TTL Loads |
| **OPL810-OC, OPL811-OC** | | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | | 100 | ns | $V_{CC}$=5V, $T_A$ = 25°C, $E_e$= 0 or |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 5.0 | | µs | 0.4mW/cm$^2$, f = 10.0kHz, DC = 50%, $R_L$ = 300Ω |

**Typical Performance Curves**

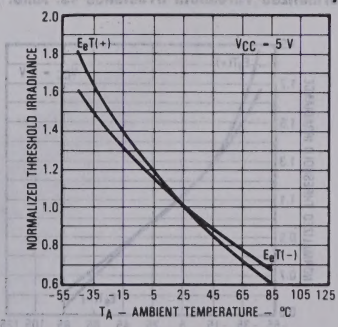
**Output Voltage vs. Ambient Temp.**




**High Output Current vs. Ambient Temp.**




**Normalized Threshold Irradiance vs. $T_A$**




PHOTOLOGIC SENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Types OPL812, OPL813 Series

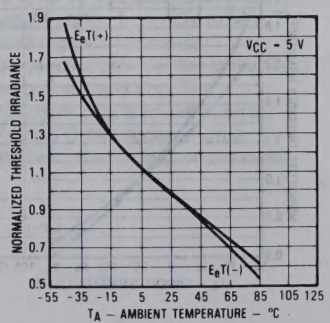
OPTEK

**Electrical Characteristics** (-40°C to +100°C unless otherwise noted) $V_{CC}$ = 4.5 to 16.0 V

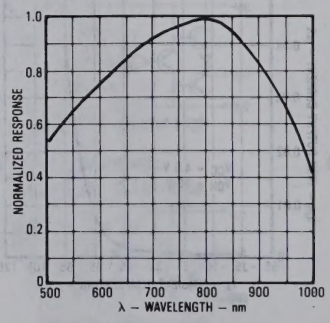
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Operating Supply Voltage | 4.5 | | 16.0 | V | |
| | Peak-to-Peak $V_{CC}$ Ripple Necessary to Cause False Triggering of Output | | | 1.0 | V | f = DC to 50 MHz |
| $E_{eT}(+)$ | Positive-Going Threshold Irradiance(3) | .005 | .025 | .10 | mW/cm$^2$ | $T_A$ = 25°C |
| $E_{eT}(+)/E_{eT}(-)$ | Hysteresis Ratio | 1.20 | 1.55 | 2.00 | | |
| $I_{CC}$ | Supply Current | | | 15.0 | mA | $E_e$ = 0 or 0.2 mW/cm$^2$ |
| **OPL812** (Buffer, Totem-Pole) | | | | | | |
| $V_{OH}$ | High Level Output Voltage | $V_{CC}$-2.1 | | | V | $I_{OH}$ = -1.0mA, $E_e$ = 0.2 mW/cm$^2$ |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = 0 |
| **OPL812-OC** (Buffer, Open-Collector) | | | | | | |
| $I_{OH}$ | High Level Output Current | | | 100 | µA | $V_{OH}$ = 30V, $E_e$ = 0.2mW/cm$^2$ |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = 0 |
| **OPL813** (Inverter, Totem-Pole) | | | | | | |
| $V_{OH}$ | High Level Output Voltage | $V_{CC}$-2.1 | | | V | $I_{OH}$ = -1mA, $E_e$ = 0 |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = 0.2mW/cm$^2$ |
| **OPL813-OC** (Inverter, Open-Collector) | | | | | | |
| $I_{OH}$ | High Level Output Current | | | 100 | µA | $V_{OH}$ = 30V, $E_e$ = 0 |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $I_{OL}$ = 16mA, $E_e$ = 0.2mW/cm$^2$ |
| **OPL812, OPL813** | | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | | 70 | ns | $V_{CC}$=5V, $T_A$= 25°C, $E_e$= 0 or 0.2mW/cm$^2$, f = 10.0kHz DC = 50%, $R_L$ = 10TTL Loads |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 5.0 | | µs | |
| **OPL812-OC, OPL813-OC** | | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | | 100 | ns | $V_{CC}$=5V, $T_A$ = 25°C, $E_e$= 0 or 0.2mW/cm$^2$, f = 10.0kHz, DC = 50%, $R_L$ = 300Ω |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 5.0 | | µs | |

**Typical Performance Curves**

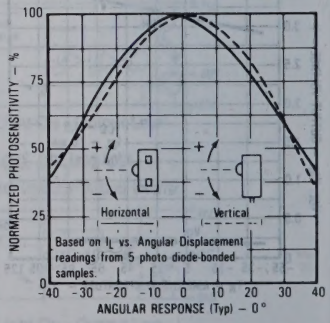
**Normalized Threshold Irradiance vs. Amb. Temp.**




**Normalized Spectral Response**



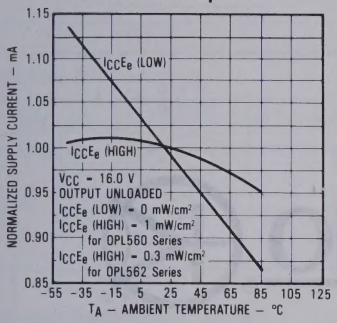

**Angular Displacement from Package Mechanical Axis**



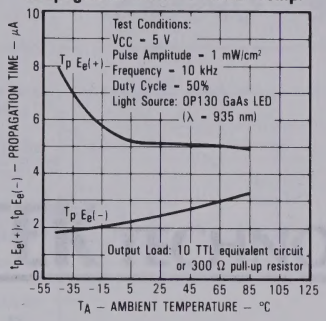

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

## Typical Performance Curves

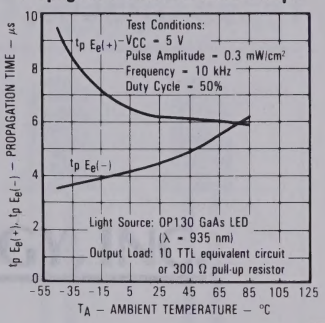
### Normalized Supply Current vs. Ambient Temperature



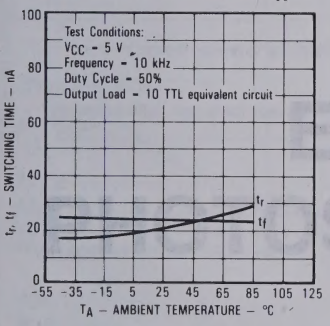

### Propagation Time vs. Amb. Temp.



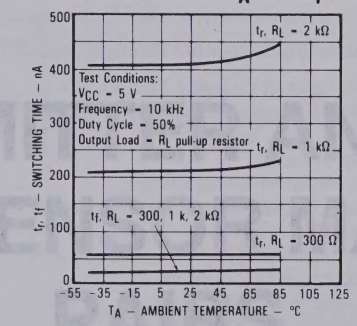

### Propagation Time vs. Amb. Temp.




### Rise Time & Fall Time vs. $T_A$

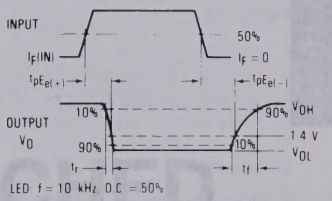



### Rise Time & Fall Time vs. $T_A$ vs. Output Load

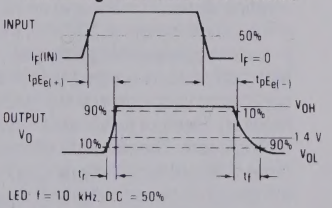

$t_r$, $t_f$ – SWITCHING TIME – nA
500
400
300
200
100
0
Test Conditions:
$V_{CC}$ = 5 V
Frequency = 10 kHz
Duty Cycle = 50%
Output Load = $R_L$ pull-up resistor
$t_r$, $R_L$ = 2 kΩ
$t_r$, $R_L$ = 1 kΩ
$t_f$, $R_L$ = 300, 1 k, 2 kΩ
$t_r$, $R_L$ = 300 Ω
-55 -35 -15 5 25 45 65 85 105 125
$T_A$ – AMBIENT TEMPERATURE – °C

### Switching Test Curves

#### Switching Test Curve for Inverters

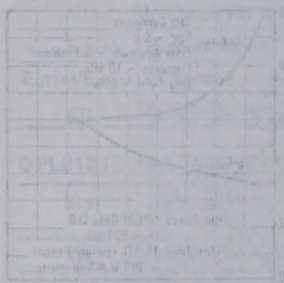


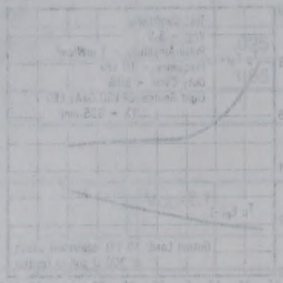

#### Switching Test Curve for Buffers

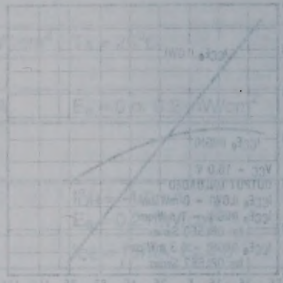


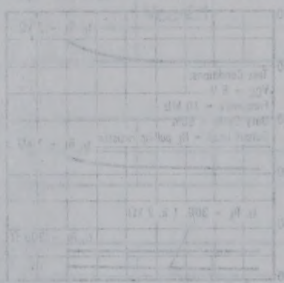

PHOTOLOGIC SENSORS

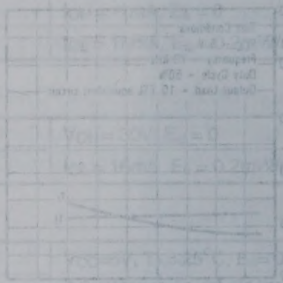
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

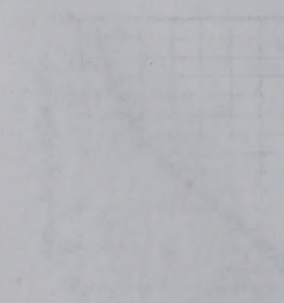


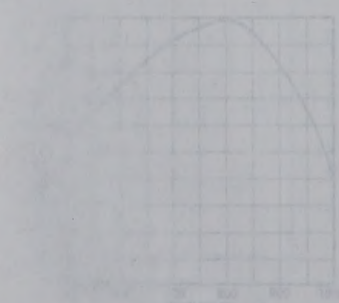








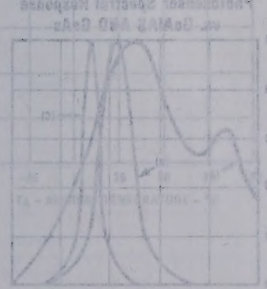




OPTEK TECHNOLOGY, INC.



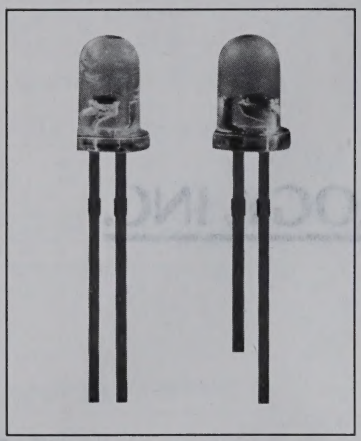
# EMITTER AND PHOTOSENSOR MATCHED PAIRS

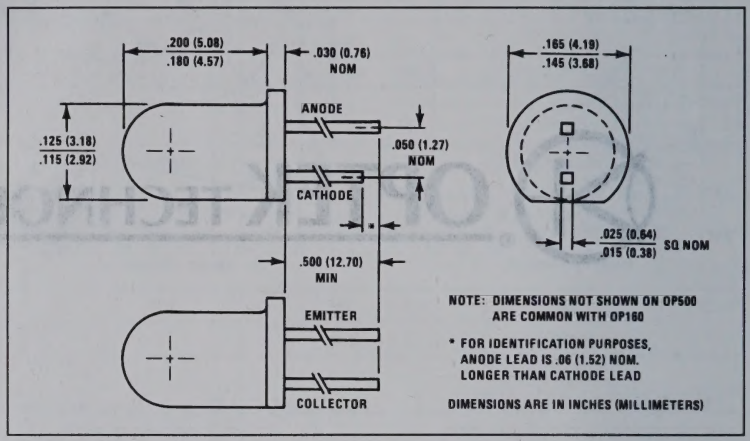


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Matched LED and Photosensor Pair
## Types OPS665, OPS666, OPS667






### Features

- T-1 package style
- High current transfer ratio
- Low cost plastic package
- Three current range selections

### Description

The OPS665 through OPS667 each consist of a gallium arsenide infrared emitting diode (OP165) and an NPN silicon phototransistor (OP505) mounted in matched plastic T-1 packages. Matched pairs are desirable where the application is unique and the quantity required does not justify assembly tooling costs. The units are offered in three different sensitivity ranges to give the designer more flexibility. If separation between the LED and sensor is greater than two times the specified $I_{C(ON)}$ distance, proper alignment becomes critical. It should be remembered that the sensor is sensitive to ambient light. Although sold as pairs, emitters are packaged separately from sensors for ease of handling.

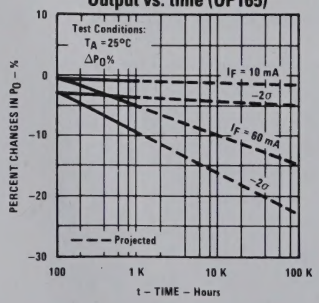
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| **Input Diode** | |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse Voltage | 2.0V |
| Power Dissipation | 100mW(2) |
| **Output Photosensor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 100mW(2) |

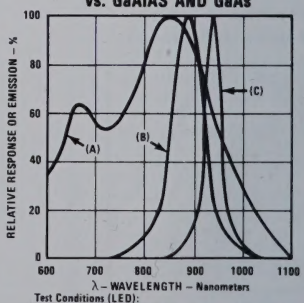
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.

### Typical Performance Curves

**Percent Changes in Power Output vs. time (OP165)**




**Photosensor Spectral Response vs. GaAlAs AND GaAs**




Test Conditions (LED):
$T_A = T_J$ = 25°C; $I_F$ = 100 mA, DC = 0.1%, PW = 100 µs
Peak Wavelength - λp: (A) XSTR – 850 ± 30 nm
(B) LED GaAlAs – 890 ± 20 nm
(C) LED GaAs – 930 ± 15 nm

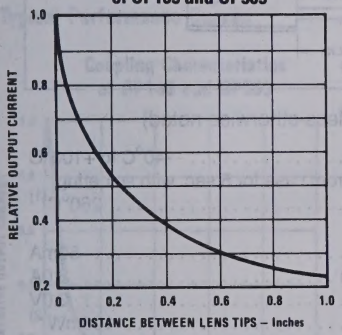
# Types OPS665, OPS666, OPS667

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

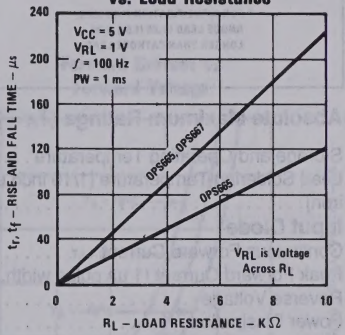
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | | | 1.60 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | | 100 | μA | $V_R$ = 2.0V |
| **Output Photosensor** | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | | V | $I_C$ = 100μA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100μA |
| $I_{CEO}$ | Collector Dark Current | | | | 100 | nA | $V_{CE}$ = 15.0V, $E_e$ = 0 |
| $I_{C(ON)}$ | On-State Collector Current | OPS665 | 0.5 | | | mA | $V_{CE}$ = 5.0V, $I_F$ = 20mA |
| | | OPS666 | 1.0 | | 10.0 | mA | d = 0.25" lens tip to lens tip |
| | | OPS667 | 5.0 | | | mA | |

## Typical Performance Curves

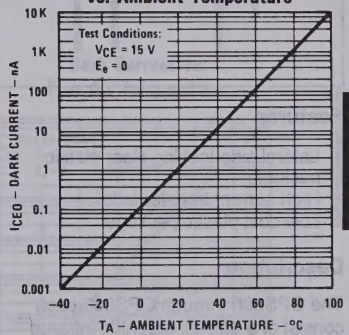
**Coupling Characteristics of OP165 and OP505**



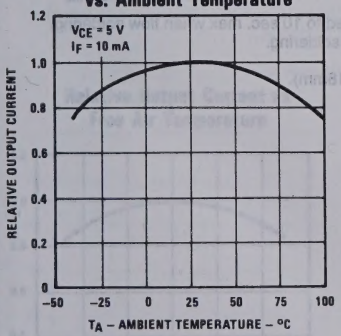

**Rise and Fall Time vs. Load Resistance**



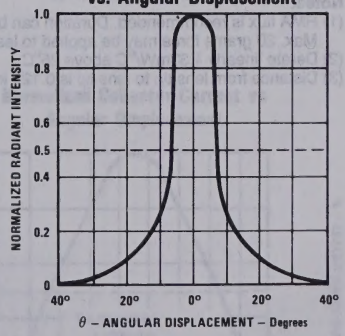

**Collector Dark Current vs. Ambient Temperature**



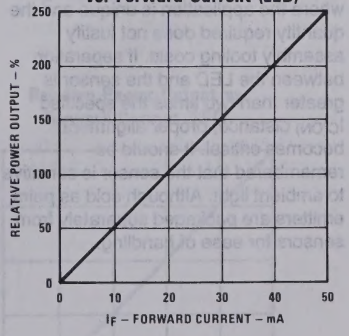

**Coupled-Relative Output Collector Current vs. Ambient Temperature**




**Emission (LED) and Response (Sensor) Normalized Radiant Intensity vs. Angular Displacement**




**Relative Power Output vs. Forward Current (LED)**

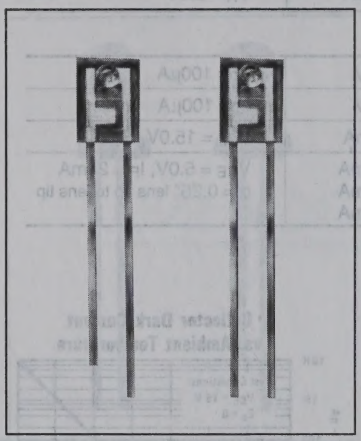


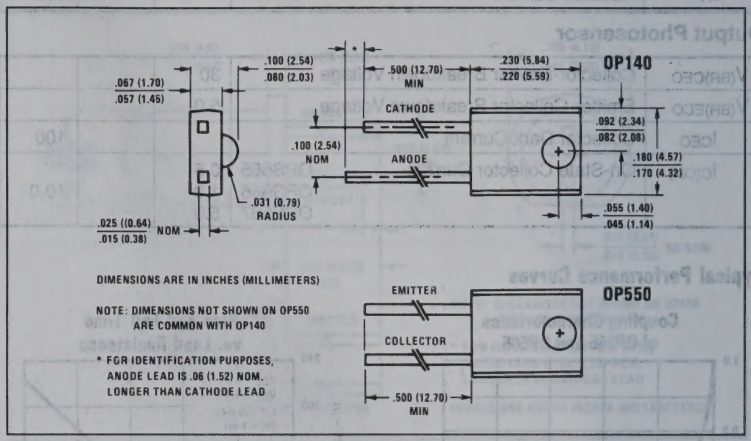

MATCHED PAIRS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Matched LED and Photosensor Pair
## Types OPS690, OPS691, OPS692, OPS693






### Features

- Lateral side-looking clear plastic package
- High current transfer ratio
- Low cost plastic package

### Description

The OPS690 through OPS693 each consist of a gallium arsenide infrared emitting diode (OP140) and an NPN silicon phototransistor (OP550) mounted in matched lateral side-looking plastic packages. Matched pairs are desirable where the application is unique and the quantity required does not justify assembly tooling costs. If separation between the LED and the sensor is greater than two times the specified $I_{C(ON)}$ distance, proper alignment becomes critical. It should be remembered that the sensor is sensitive to ambient light. Although sold as pairs, emitters are packaged separately from sensors for ease of handling.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| **Input Diode** | |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse Voltage | 2.0V |
| Power Dissipation | 100mW(2) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 100mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) Distance from lens tip to lens tip is 0.125 inches (3.18mm).

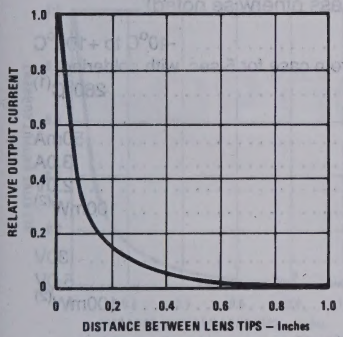
# Types OPS690, OPS691, OPS692, OPS693

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

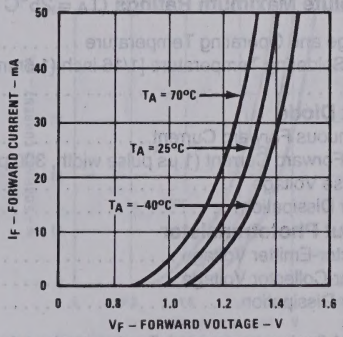
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | | | 1.60 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | | V | $I_C$ = 100µA, $E_e$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA, $E_e$ = 0 |
| $I_{CEO}$ | Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0 |
| **Coupled** | | | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | | | | 0.40 | V | $I_F$ = 20mA, $I_C$ = 50µA(3) |
| $I_{C(ON)}$ | On-State Collector Current | OPS690 | 100 | | | µA | $V_{CE}$ = 10.0V, $I_F$ = 20mA(3) |
| | | OPS691 | 500 | | | µA | |
| | | OPS692 | 1.0 | | | mA | |
| | | OPS693 | 2.0 | | | mA | |

## Typical Performance Curves

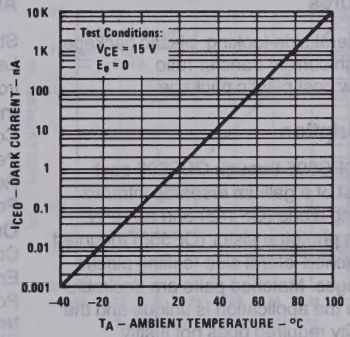
**Coupling Characteristics of OP140 and OP550**



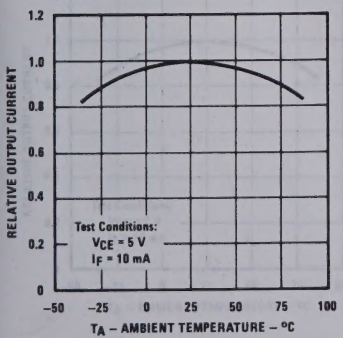

**Forward Current vs Forward Voltage**



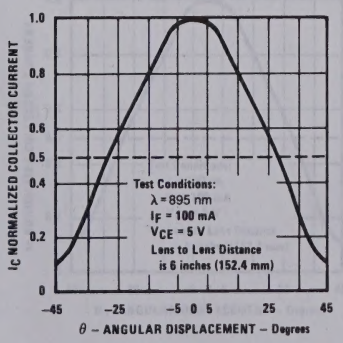

**Dark Current vs Free Air Temperature**



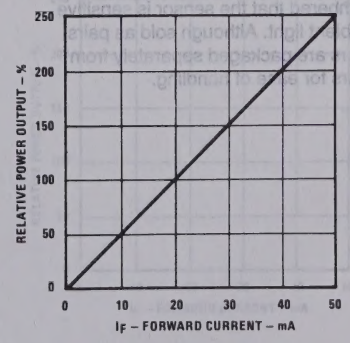

**Relative Output Current vs Free Air Temperature**




**Normalized Collector Current vs Angular Displacement**




**Relative Power Output vs Forward Current (LED)**

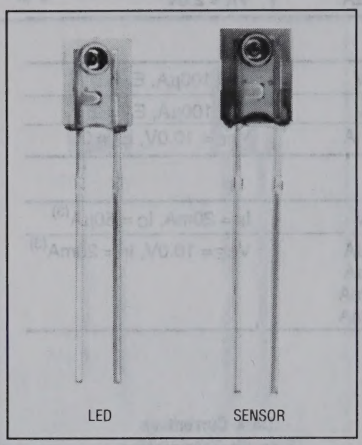


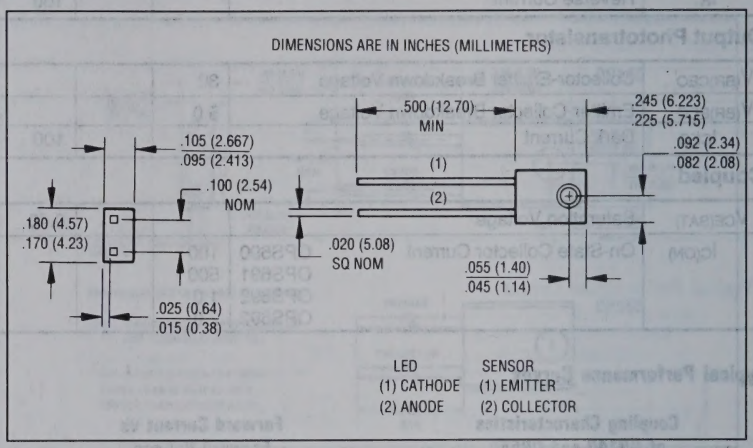

MATCHED PAIRS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Matched LED and Photosensor Pair
## Types OPS695, OPS696, OPS697, OPS698




### Features

- Lateral side-looking plastic package
- High current transfer ratio
- Low cost plastic package

### Description

The OPS695 through OPS698 each consist of a gallium arsenide infrared emitting diode (OP145) and an NPN silicon phototransistor (OP555) mounted in matched lateral side-looking plastic packages. Matched pairs are desirable where the application is unique and the quantity required does not justify assembly tooling costs. If separation between the LED and the sensor is greater than two times the specified $I_{C(ON)}$ distance, proper alignment becomes critical. It should be remembered that the sensor is sensitive to ambient light. Although sold as pairs, emitters are packaged separately from sensors for ease of handling.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| **Input Diode** | |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse Voltage | 2.0V |
| Power Dissipation | 100mW(2) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 100mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) Distance from lens tip to lens tip is 0.125 inches (3.18mm).

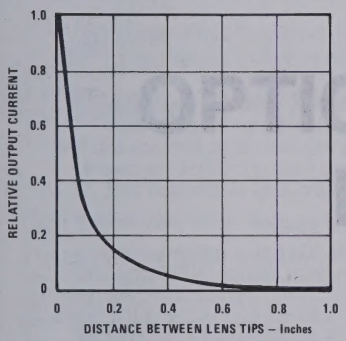
# Types OPS695, OPS696, OPS697, OPS698

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

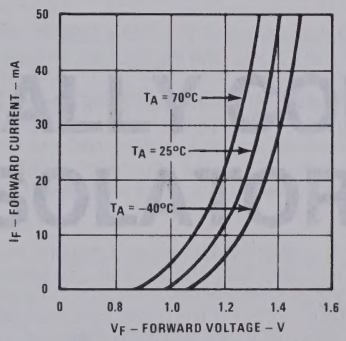
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | | | 1.60 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | | V | $I_C$ = 100µA, $E_e$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA, $E_e$ = 0 |
| $I_{CEO}$ | Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0 |
| **Coupled** | | | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | | | | 0.40 | V | $I_F$ = 20mA, $I_C$ = 50µA[3] |
| $I_{C(ON)}$ | On-State Collector Current | OPS695 | 100 | | | µA | $V_{CE}$ = 10.0V, $I_F$ = 20mA[3] |
| | | OPS696 | 500 | | | µA | |
| | | OPS697 | 1.0 | | | mA | |
| | | OPS698 | 2.0 | | | mA | |

## Typical Performance Curves

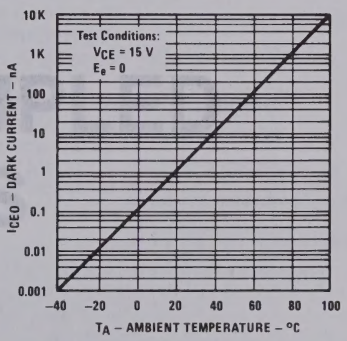
**Coupling Characteristics of OP145 and OP555**



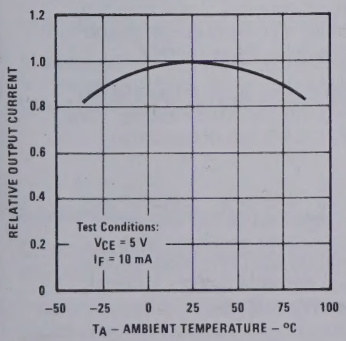

**Forward Current vs Forward Voltage**



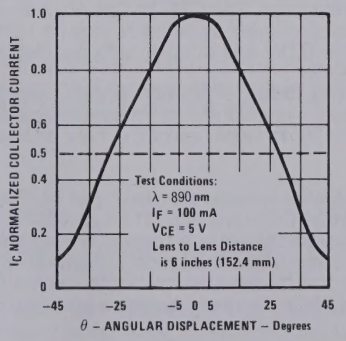

**Dark Current vs Free Air Temperature**



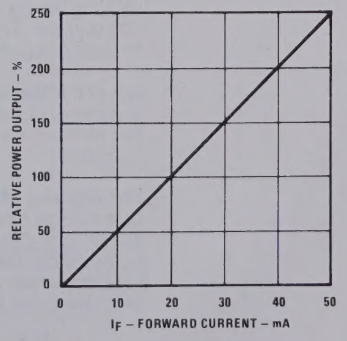

**Relative Output Current vs Free Air Temperature**




**Normalized Collector Current vs Angular Displacement**



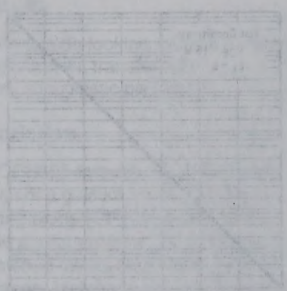

**Relative Power Output vs Forward Current (LED)**

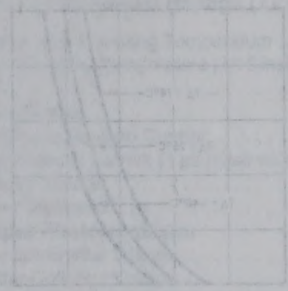


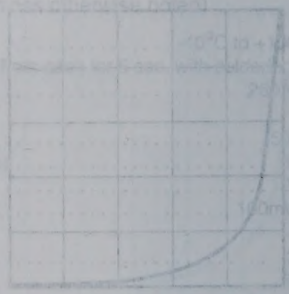


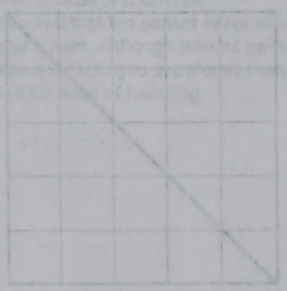

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

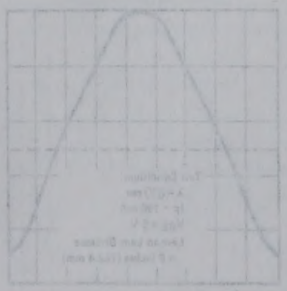
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

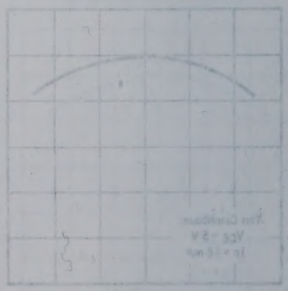












OPTEK TECHNOLOGY, INC.

# OPTICALLY COUPLED ISOLATORS



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Optically Coupled Isolators

Optically coupled isolators, also called optocouplers, are used to isolate one electrical system from another in an electronic circuit. They allow direct circuit control with complete electrical isolation of input from output. These isolators are considered the best, most cost effective devices to eliminate associated differential ground, ground loop and EMI/RFI problems.

An optically coupled isolator consists of an IRED (infrared emitting diode) connected to the input circuit, optically coupled to a silicon photosensor at the output circuit. Both IRED and photosensor are housed in a single package with a light-conducting medium between them.

Optically coupled isolators are used in control and computer networks to isolate electrical "spikes" in one part of the circuit from transmission to another part. These isolators are especially useful in appliances and manually controlled electronic equipment to guard the operator against direct electrical contact with the line voltage. They can also serve as replacements for DC transformers or mechanical relays. With twenty years of experience in the design and manufacture of optically coupled isolators, Optek is a market leader in high technology and specialty couplers. Optek led the industry by obtaining the first VDE approved IR optoisolator.

The Optek product line is broad and can meet a wide variety of unique applications. The line consists of:

- **Standard couplers** are available with (1) either phototransistor or photodarlington output, (2) current transfer ratios (CTR) as high as 400 percent, and (3) input current as low as 0.5 mA.
- **Specialty couplers** available in several styles of hermetic packages, with isolation voltages up to 50,000 VDC, with guaranteed CTRs up to 700 percent, and with input currents as low as 5 mA.
- **High technology couplers** with TTL-compatible Photologic™ output, with isolation voltages up to 15,000 VDC, and with the ultimate in speed - up to 5 MHz - available.

## Standard Optically Coupled Isolators

Optek's standard optocoupler line features optocouplers especially useful in applications requiring high voltage and noise isolation. Among such applications are computer and telephone interconnections, and level shifting and interfacing between logic families and low input current line receivers. When the application is networking among multiple hardware units, optically coupled isolators should be designed in for ground loop elimination and electrical protection.

Optek standard optocouplers contain either a gallium arsenide (GaAs) or gallium aluminum arsenide (GaAlAs) IRED as input, and a silicon (Si) phototransistor sensor (NPN type) as output. The coupling medium between the IRED and sensor is a high dielectric silicone gel. The infrared light emitted from the IRED has a wavelength of 930 nm for the GaAs IRED and 890 for the GaAlAs IRED. Both are spectrally matched with the photosensor peak spectral response, centered at 850 nm, in order to assure optimum DC transfer characteristics.

The key design parameters of an optically coupled isolator are the current transfer ratio (CTR), which is a measure of the output current for a given input current, and the isolation voltage, which is the amount of voltage that can be applied between input and output without causing arcing or breakdown. The CTR for Optek's standard optocouplers range from 2 to 400 percent. The isolation voltages range as high as 15000 VDC. Specialty couplers and custom products have CTRs and isolation voltages that often exceed these ranges.

Optek's leadership in optoisolator technology and manufacture began 20 years ago when engineers developed the company's first infrared optoisolator using hermetic devices. Today, this product, the OPI120, remains one of the more popular of Otpek's line of specialty couplers.

The line also offers a wide selection of case types and electrical variations. Isolation voltages range from 1000 VDC in hermetic TO-5 and TO-72 packages, to 50 KV DC, made possible by Optek's development of an optical waveguide and custom package using hermetic discretes. Some of the line's most cost effective parts are the OPI1264A, B, and C types, which offer 10 KV electrical isolation in a popular axial package design. Choices of CTRs of 25, 50 or 100 percent are available with phototransistor output.

The OPI102, and OPI103 and JEDEC registered 3N and 4N types are hermetically packaged in TO-5 and TO-72 metal cans. CTRs range from 15 to 100 percent, and the parts feature phototransistor output for easy design-in to most circuits. The Hi-Rel and Military parts section of this data book contain descriptions of JAN and JANTX versions of many of these specialty coupler products.

### High Technology or Photologic™ Couplers

Optek's development of Photologic™ advanced IC photosensors has also led to the design of high technology couplers with 250 K-Baud TTL capability. They represent four types of output: buffer totem-pole, buffer open-collector, inverter totem-pole, and inverter open-collector. If high voltage electrical isolation is required, the OPI125 through OPI128 are photodarlington optocouplers with 15,000 VDC isolation in a hermetic axial-leaded package.

### SURFACE MOUNT

The OPI210, OPI211 optoisolators consist of an LED and a silicon phototransistor mounted and coupled on a thick film ceramic substrate. These solid-state optocouplers are ideal for hybrid applications. Optoisolation is rated at 1000 VDC. Four thick film bonding pads make the electrical connections easy. Device mounting may be achieved using silver or gold filled epoxies.

A full line of hermetic chip carriers is also offered which are surface mountable on ceramic or printed circuit boards. The miniature package saves circuit board area. Many of the popular 4N series optoisolators are available in this HCC series of optocouplers shown in the surface mount area of this data book. High speed (1megabit/second) TTL versions are also available.

### High Speed Very High Voltage Isolator

The OPI1266 features isolation to 16KV DC with a transfer rate to 500 kbits as standard. The OPI1266 optoisolator consists of a GaAlAs LED coupled with a unique integrated circuit detector. Photons are collected in the detector by a photodiode and amplified by a high gain linear amplifier that drives a Schottky clamped open collector output transistor. The circuit is temperature, current, and voltage compensated. This design produces maximum DC and AC current isolation between input and output while providing TTL/LSTTL circuit compatibility. Propagation delay times are matched within 500ns over the entire temperature range for timing purposes.

### Custom Optoisolator Capability

In some critical applications, standard electrical characteristics or package types simply will not work. Optek has extensive experience in designing and manufacturing custom optoisolators to meet the most demanding application requirements.

### Leadership in Advanced Coupler Research

Optek has recently patented surface mount optoisolators, OPI210 and OPI211, symbols of Optek's leadership through optoisolator technology.

Projects currently in progress at Optek include operating speed improvements, increased photosensor functionality, input sensitivity enhancements, and innovations in package designs. Optek continues to lead the industry in state-of-the-art optically coupled isolators.

### Applications

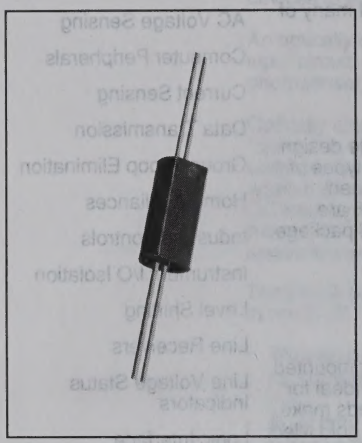
- AC Voltage Sensing
- Computer Peripherals
- Current Sensing
- Data Transmission
- Ground Loop Elimination
- Home Appliances
- Industrial Controls
- Instrument I/O Isolation
- Level Shifting
- Line Receivers
- Line Voltage Status Indicators
- Logic Interface
- Microprocessor Interface
- Motor or Light Controls
- Network Isolation
- Polarity Sensing
- Solid State Relays
- Switching Power Supply
- Telephone Ring Detection
- Telephone Switching

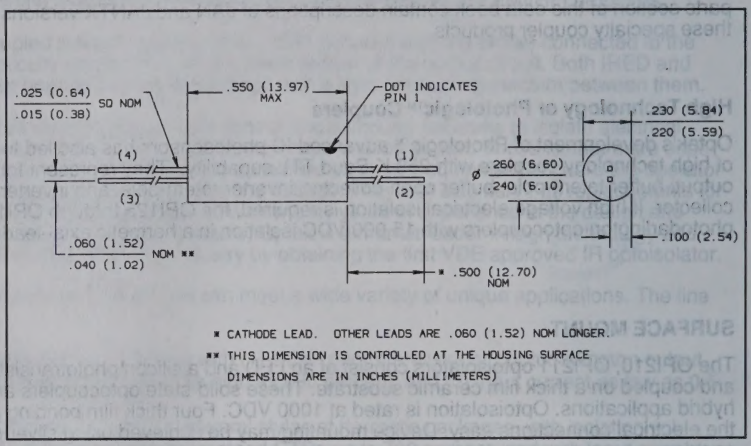


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Optically Coupled Isolators
## Types OPI110, OPI110A, OPI110B, OPI110C, OPI113






### Features

- 10kV electrical isolation
- Phototransistor output
- Low cost plastic housing
- UL Recognized File Number E58730[6]

### Description

The OPI110 and OPI113 series devices are optically coupled isolators, each containing an infrared emitting diode and an NPN silicon photosensor. The OPI110 uses a phototransistor and the OPI113 uses either a photodarlington or phototransistor sensor. The devices are sealed in a precast opaque housing. This series is designed for applications requiring high voltage isolation between input and output.

### Replaces

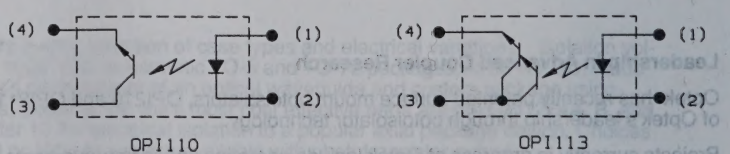
K8900 series

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ± 10kVDC[1][6] |
| Storage Temperature Range | -40°C to +100°C |
| Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C[2] |
| **Input Diode** | |
| Forward DC Current | 40mA[3] |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 50mW[4] |
| **Output Photosensor** | |
| Collector-Emitter Voltage OPI110 | 30V |
| OPI113 | 15V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 100mW[5] |

**Notes:**
(1) Measured with input and output leads shorted. Typical input/output capacitance is 0.06pF.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.67mA/°C above 25°C.
(4) Derate linearly 0.83mW/°C above 25°C.
(5) Derate linearly 1.67mW/°C above 25°C.
(6) UL recognition is for 3500 VAC, 1 minute only.

### Schematics



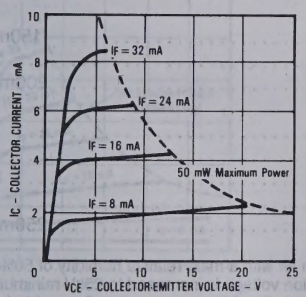
# Types OPI110, OPI110A, OPI110B, OPI110C, OPI113

**Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)**

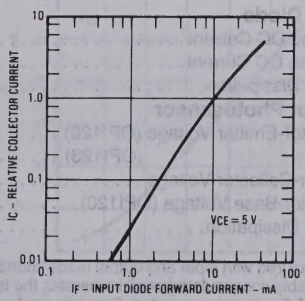
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | | | 1.60 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | | 100 | μA | $V_R$ = 2.0 V |
| **Output Photosensor** | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | OPI110 | 30 | | | V | $I_C$ = 100 μA |
| | | OPI113 | 15 | | | V | $I_C$ = 100 μA, $I_F$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100 μA, $I_F$ = 0 |
| $I_{CEO}$ | Collector-Emitter Dark Current | OPI110 | | | 100 | nA | $V_{CE}$ = 15 V, $E_e$ = 0 |
| | | OPI113 | | | 100 | nA | $V_{CE}$ = 10 V, $E_e$ = 0 |
| **Coupled** | | | | | | | |
| $I_C/I_F$ | DC Current Transfer Ratio | OPI110 | 12.5 | | | % | $I_F$ = 10.0 mA, $V_{CE}$ = 5.0 V |
| | | OPI110A | 25 | | | % | $I_F$ = 10.0 mA, $V_{CE}$ = 5.0 V |
| | | OPI110B | 50 | | 125 | % | $I_F$ = 10.0 mA, $V_{CE}$ = 5.0 V |
| | | OPI110C | 100 | | | % | $I_F$ = 10.0 mA, $V_{CE}$ = 5.0 V |
| | | OPI113 | 50 | 400 | | % | $I_F$ = 5.0 mA, $V_{CE}$ = 2.0 V |
| $V_{CE(SAT)}$ | Collector Saturation Voltage | OPI110 | | | 0.40 | V | $I_F$ = 10.0 mA, $I_C$ = 1.6 mA |
| | | OPI113 | | | 1.20 | V | $I_F$ = 10.0 mA, $I_C$ = 5.0 mA |
| $I_{CEO}$ | Collector-Emitter Dark Current | OPI110 | | | 200 | nA | $V_{CE}$ = 20.0 V, $I_F$ = 0 |
| | | OPI113 | | | 100 | nA | $V_{CE}$ = 10.0 V, $I_F$ = 0 |
| $V_{ISO}$ | Isolation Voltage | | 10.0 | | | kVDC | (See Note 1) |

**Typical Performance Curves (OPI110 Only)**

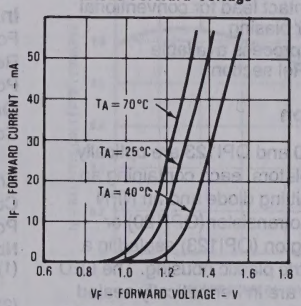
**Collector Current vs Collector-Emitter Voltage**



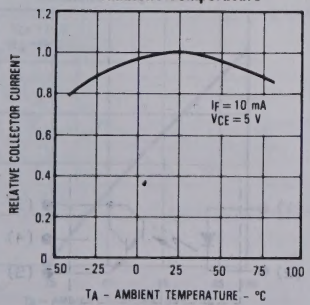

**Relative Collector Current vs Diode Forward Current**



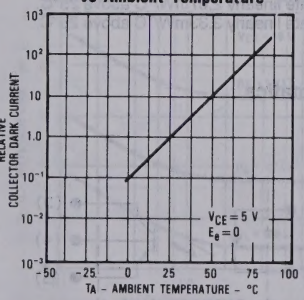

**Diode Forward Current vs Diode Forward Voltage**



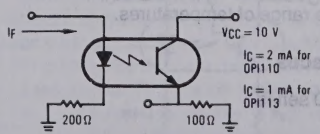

**Relative Collector Current vs Ambient Temperature**




**Relative Collector Dark Current vs Ambient Temperature**




**Switching Time Test Circuit**

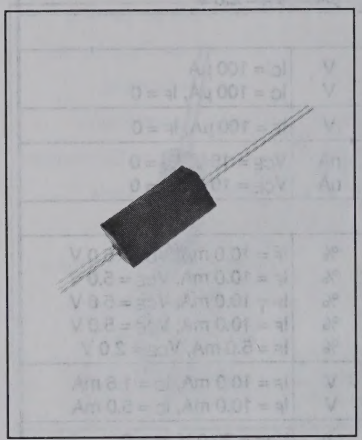


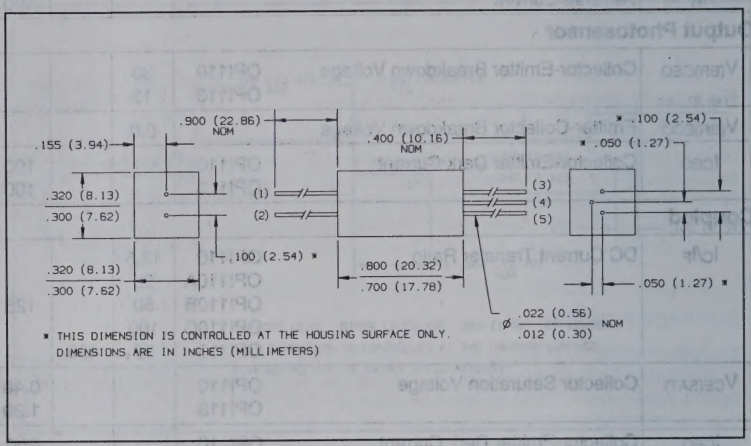

$t_r$ and $t_f$ for OPI110 are typically 4 μs.
$t_r$ and $t_f$ for OPI113 are typically 40 μs.
The input waveform is supplied by a generator with the following characteristics: $Z_{OUT}$ = 50Ω, $t_r \leq 15$ ns, duty cycle ≅ 1%, pulse width = 100 μs.



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Optically Coupled Isolators
## Types OPI120, OPI123






### Features

- 15kV electrical isolation
- Phototransistor output (OPI120) or photodarlington output (OPI123)
- Hermetically sealed LED and photosensor
- Base contact lead for conventional transistor biasing
- TX-TXV process available (see Hi-Rel section)

### Description

The OPI120 and OPI123 are optically coupled isolators, each containing an infrared emitting diode and an NPN silicon phototransistor (OPI120) or photodarlington (OPI123) sealed in a high dielectric plastic housing. The LED and sensor are in hermetically sealed packages. These series are designed for applications requiring high voltage isolation between input and output over a wide range of temperatures.

### Replaces

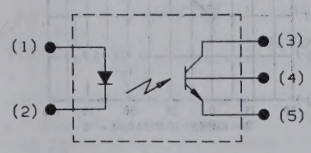
K8920 series

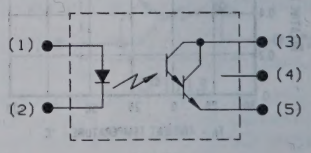
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ± 15kVDC(1) |
| Storage Temperature Range | -55°C to +125°C |
| Operating Temperature Range | -55°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(2) |
| **Input Diode** | |
| Forward DC Current | 150mA(3) |
| Reverse DC Current | 3.0V |
| Power Dissipation | 200mW(4) |
| **Output Photosensor** | |
| Collector-Emitter Voltage (OPI120) | 25V |
| (OPI123) | 20V |
| Emitter-Collector Voltage | 5.0V |
| Collector-Base Voltage (OPI120) | 25V |
| Power Dissipation | 250mW(5) |

**Notes:**
(1) Measured with input and output leads shorted in air with a max. relative humidity of 50%. If suitably encapsulated or oil immersed, the isolation voltage is increased to 25kV minimum.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 2.0mA/°C above 25°C.
(4) Derate linearly 2.67mW/°C above 25°C.
(5) Derate linearly 3.33mW/°C above 25°C.

### Schematics



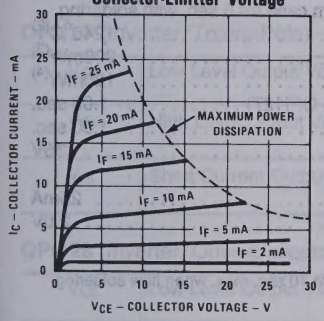
# Types OPI120, OPI123

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

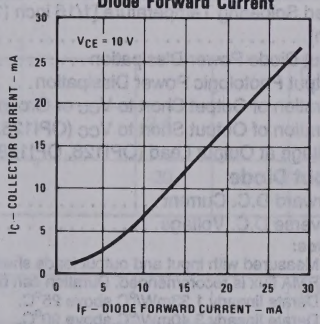
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | OPI120 | | | 1.50 | V | $I_F$ = 30.0mA |
| | | OPI123 | | | 1.50 | V | $I_F$ = 10.0mA |
| $I_R$ | Reverse Current | OPI120 | | | 100 | µA | $V_R$ = 3.0V |
| | | OPI123 | | | 100 | µA | $V_R$ = 3.0V |
| **Output Photosensor** | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | OPI120 | 25 | | | V | $I_C$ = 1.00mA |
| | | OPI123 | 20 | | | V | $I_C$ = 1.00mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | OPI120 | 25 | | | V | $I_C$ = 1.00µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V |
| **Coupled** | | | | | | | |
| $I_C/I_F$ | DC Current Transfer Ratio | OPI120 | 20 | 70 | | % | $I_F$ = 10.0mA, $V_{CE}$ = 5.0V |
| | | OPI123 | 50 | | | % | $I_F$ = 10.0mA, $V_{CE}$ = 2.0V |
| $V_{CE(SAT)}$ | Saturation Voltage | OPI120 | | | 0.50 | V | $I_F$ = 30mA, $I_C$ = 1.00mA |
| | | OPI123 | | | 1.20 | V | $I_F$ = 5.0mA, $I_C$ =1.00mA |
| $V_{ISO}$ | Isolation Voltage | | 15.0 | | | kV | (See Note 1) |
| $t_r$ | Output Rise Time | OPI120 | | 2.0 | | µs | See Test Circuit |
| | | OPI123 | | 40 | | µs | See Test Circuit |
| $t_f$ | Output Fall Time | OPI120 | | 2.0 | | µs | See Test Circuit |
| | | OPI123 | | 40 | | µs | See Test Circuit |

## Typical Performance Curves (OPI120 Only)

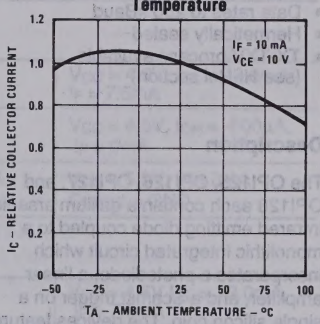
**Collector Current vs. Collector-Emitter Voltage**



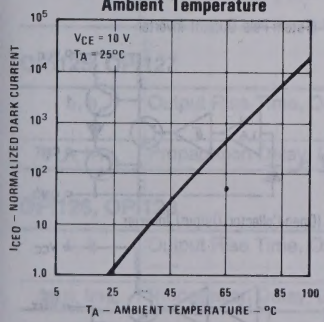

**Collector Current vs. Diode Forward Current**



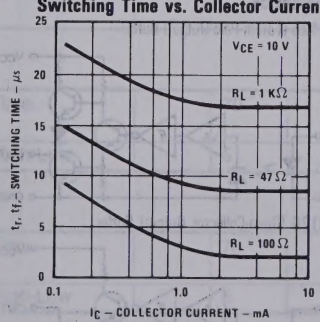

**Relative Collector Current vs. Temperature**



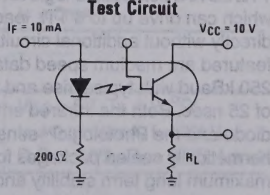

**Normalized Dark Current vs. Ambient Temperature**




**Switching Time vs. Collector Current**




**Test Circuit**



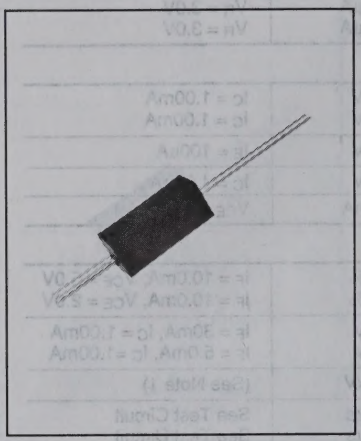

The input waveform is supplied by a generator with the following characteristics: $Z_{OUT}$ = 50Ω, $t_r \leq$ 15 ns. Duty cycle ≈ 1%, pulse width ≈ 100 µs.

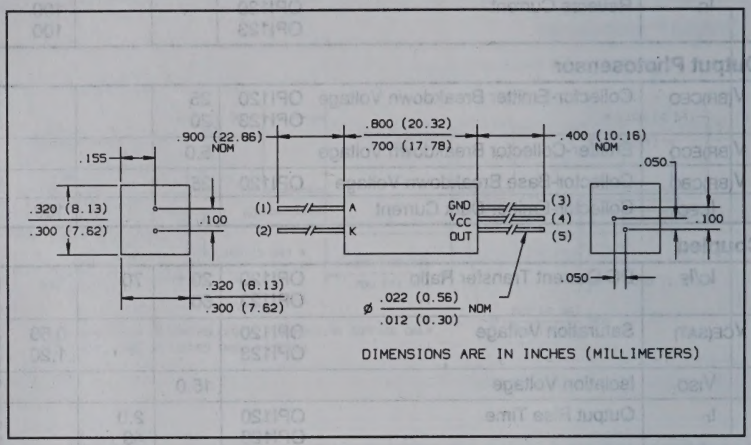
OPTICALLY COUPLED ISOLATORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Photologic™ Optically Coupled Isolators
## Types OPI125, OPI126, OPI127, OPI128






### Features

- Four output options
- 15kV input-to-output isolation voltage
- Direct TTL/STTL interface
- High noise immunity
- Data rates to 250 kBaud
- Hermetically sealed
- TX-TXV process available (see Hi-Rel section)

### Description

The OPI125, OPI126, OPI127, and OPI128 each contain a gallium arsenide infrared emitting diode coupled to a monolithic integrated circuit which incorporates a photodiode, a linear amplifier, and a Schmitt trigger on a single silicon chip. The devices feature TTL/LSTTL compatible logic level output which can drive up to 8 TTL loads directly without additional circuitry. Also featured are medium speed data rates to 250 kBaud with typical rise and fall times of 25 nsec. Both the infrared emitting diode and the Photologic™ sensor are in hermetically sealed packages for maximum long term stability and are mounted in a high dielectric plastic housing.

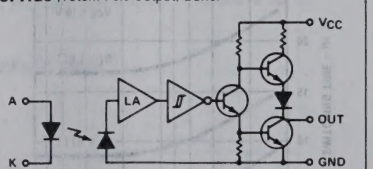
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ±15kVDC(1) |
| Supply Voltage, $V_{CC}$ (not to exceed 3 sec.) | +10.0V |
| Storage Temperature Range | -55°C to +100°C |
| Operating Temperature Range | -55°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |
| Input Diode Power Dissipation | 200mW(3) |
| Output Photologic Power Dissipation | 120mW(4) |
| Duration of Output Short to $V_{CC}$ or Ground (OPI125, OPI127) | 1.00 sec. |
| Duration of Output Short to $V_{CC}$ (OPI126, OPI128) | 1.00 sec. |
| Voltage at Output Lead (OPI126, OPI128) | 35V |
| **Input Diode** | |
| Forward D.C. Current | 25mA |
| Reverse D.C. Voltage | 2.0V |

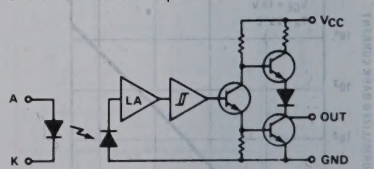
**Notes:**
(1) Measured with input and output leads shorted.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 1.33mW/°C above 25°C.
(4) Derate linearly 3.40mW/°C above 90°C.

### Schematics

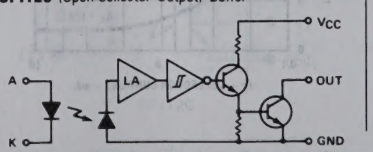
**OPI125** (Totem-Pole Output) Buffer



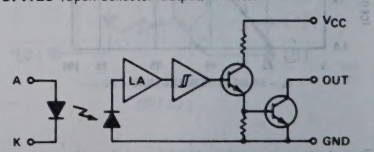

**OPI127** (Totem-Pole Output) Inverter




**OPI126** (Open-Collector Output) Buffer




**OPI128** (Open-Collector Output) Inverter




Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPI125, OPI126, OPI127, OPI128

**Electrical Characteristics** (-40°C to +85°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Diode Input** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.50 | V | $I_F$ = 10.0mA, $T_A$ = 25°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V, $T_A$ = 25°C |
| $I_{F(+)}$ | LED Positive-Going Threshold Current | | | 7.5 | mA | $V_{CC}$ = 5.0V, $T_A$ = 25°C |
| $I_{F(+)}/I_{F(-)}$ | Hysteresis Ratio | | 2.0 | | | |
| **Photologic™ Output** | | | | | | |
| $V_{CC}$ | Operating Supply Voltage | 4.5 | | 5.5 | V | |
| $I_{CC}$ | Supply Current | | | 20 | mA | $V_{CC}$ = 5.5V, $I_F$ = 0 or 7.5mA |
| **OPI125** (Buffer, Totem-Pole) | | | | | | |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $V_{CC}$ = 4.5V, $I_{OL}$ = 13.0mA, $I_F$ = 0mA |
| $V_{OH}$ | High Level Output Voltage | 2.4 | | | V | $V_{CC}$ = 4.5V, $I_{OH}$ = -800µA, $I_F$ = 7.5mA |
| $I_{OS}$ | Short Circuit Output Current | -20 | | -120 | mA | $V_{CC}$ = 5.5V, $I_F$ = 7.5mA, Output = GND |
| **OPI126** (Buffer, Open-Collector) | | | | | | |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $V_{CC}$ = 4.5V, $I_{OL}$ = 13.0mA, $I_F$ = 0mA |
| $I_{OH}$ | High Level Output Current | | | 100 | µA | $V_{CC}$ = 4.5V, $V_{OH}$ = 30V, $I_F$ = 7.5mA |
| **OPI127** (Inverter, Totem-Pole) | | | | | | |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $V_{CC}$ = 4.5V, $I_{OL}$ = 13.0mA, $I_F$ = 7.5mA |
| $V_{OH}$ | High Level Output Voltage | 2.4 | | | V | $V_{CC}$ = 4.5V, $I_{OH}$ = -800µA, $I_F$ = 0mA |
| $I_{OS}$ | Short Current Output Current | -20 | | -120 | mA | $V_{CC}$ = 5.5V, $I_F$ = 0mA, Output = GND |
| **OPI128** (Inverter, Open-Collector) | | | | | | |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $V_{CC}$ = 4.5V $I_{OL}$ = 13.0mA, $I_F$ = 7.5mA |
| $I_{OH}$ | High Level Output Current | | | 100 | µA | $V_{CC}$ = 4.5V, $V_{OH}$ = 30V, $I_F$ = 0mA |
| **OPI125, OPI127** | | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | 70 | | ns | $V_{CC}$ = 5V, $T_A$ = 25°C, $I_F$ = 0 or 10mA, f = 10kHz, D.C. = 50%, $R_L$ = 8TTL Loads |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 5 | | µs | |
| **OPI126, OPI128** | | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | 70 | | ns | $V_{CC}$ = 5V, $T_A$ = 25°C, $I_F$ = 0 or 10mA, f = 10kHz, D.C. = 50%, $R_L$ = 360 Ω |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 5 | | µs | |



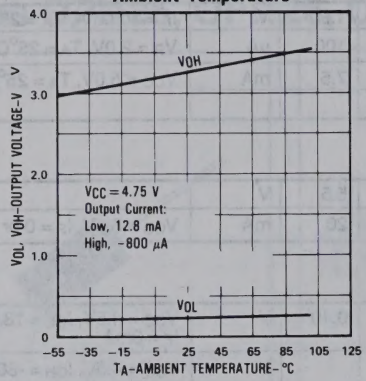
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

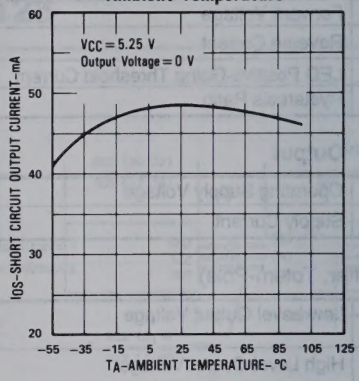
## Typical Performance Curves

### OPI125, OPI127

**Output Voltage vs. Ambient Temperature**

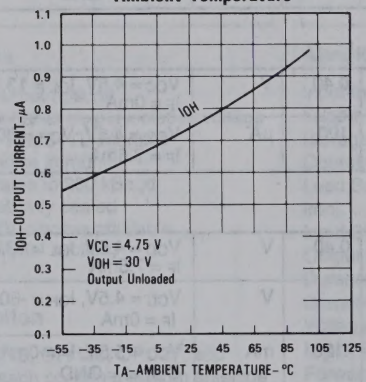



**Short Circuit Output Current vs. Ambient Temperature**

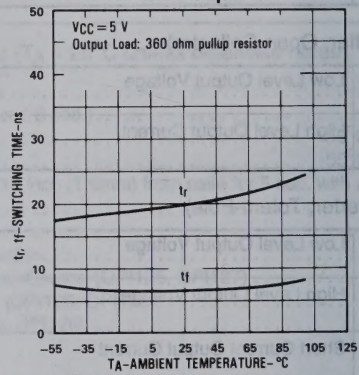



### OPI126, OPI128

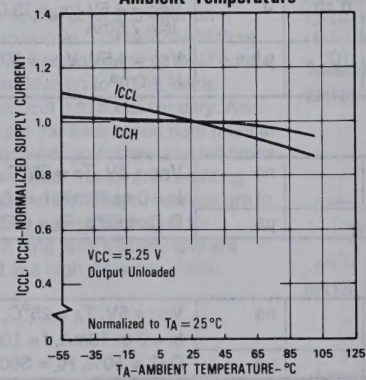
**Output Current (High) vs Ambient Temperature**



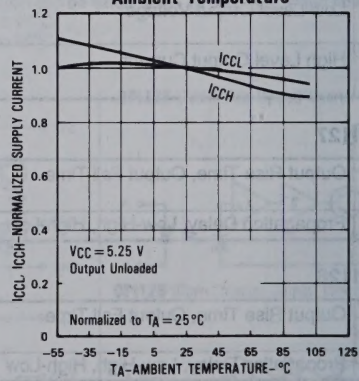

**Rise Time and Fall time vs Ambient Temperature**




**OPI125, OPI126**
**Normalized Supply Current vs Ambient Temperature**



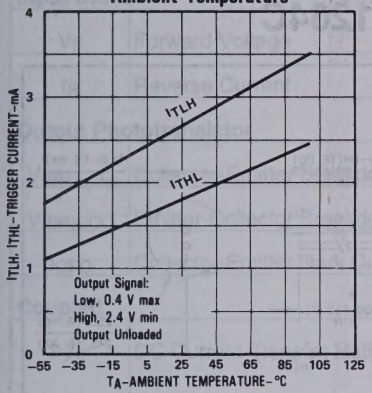

**OPI127, OPI128**
**Normalized Supply Current vs Ambient Temperature**



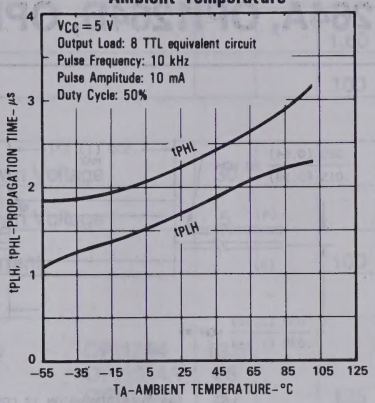

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

## Typical Performance Curves

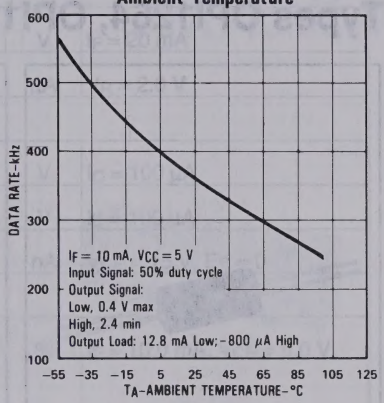
### Trigger Current vs Ambient Temperature



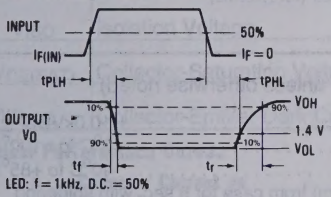

### Propagation Time vs Ambient Temperature




### Data Rate vs Ambient Temperature

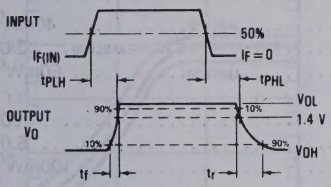

DATA RATE–kHz
IF = 10 mA, VCC = 5 V
Input Signal: 50% duty cycle
Output Signal:
Low, 0.4 V max
High, 2.4 min
Output Load: 12.8 mA Low; –800 µA High
TA–AMBIENT TEMPERATURE–°C

### Switching Test Curve for Inverters




LED: f = 1kHz, D.C. = 50%

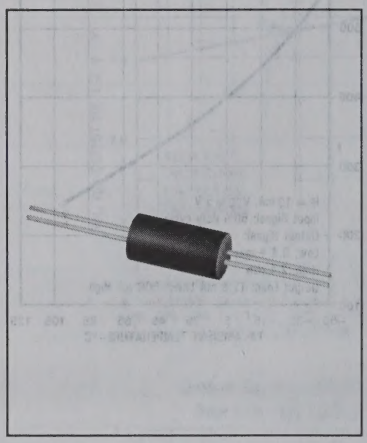
### Switching Test Curve for Buffers

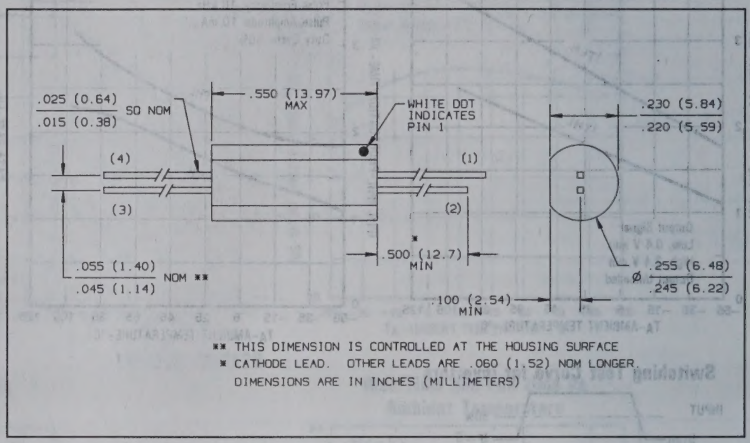



LED: f = kHz, D.C. = 50%

OPTICALLY COUPLED ISOLATORS

# Optically Coupled Isolators
## Types OPI1264, OPI1264A, OPI1264B, OPI1264C






### Features

- 10kV electrical rating
- High current transfer ratio
- Low cost plastic module
- UL recognized File NO. E58730(6)

### Description

The OPI1264 series are optically coupled isolators, each consisting of an infrared emitting diode coupled to an NPN silicon phototransistor and sealed in a precast opaque housing. The isolators are designed for applications requiring high voltage isolation between input and output.

### Replaces

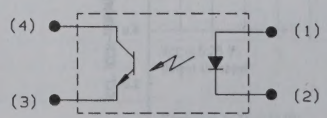
K8900 series

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ±10.0kVDC(1)(6) |
| Storage Temperature Range | -40°C to +100°C |
| Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(2) |
| **Input Diode** | |
| Forward DC Current | 40mA(3) |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 50mW(4) |
| **Output Photosensor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 100mW(5) |

**Notes:**
(1) Measured with input and output leads shorted. Typical input/output capacitance is 0.06pf.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.67mA/°C above 25°C.
(4) Derate linearly 0.83mW/°C above 25°C.
(5) Derate linearly 1.66mW/°C above 25°C.
(6) UL recognition is for 3500 VAC, 1 minute only.

### Schematic




OPI1264

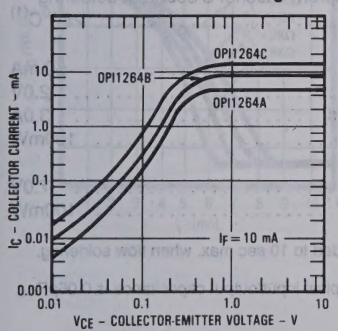
# Types OPI1264, OPI1264A, OPI1264B, OPI1264C

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

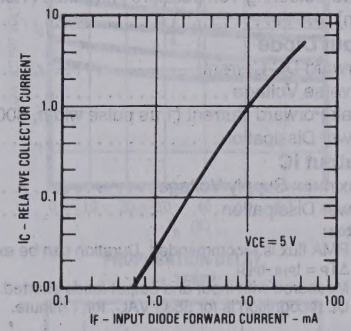
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | | | 1.60 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0 V |
| **Output Phototransistor** | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | | V | $I_C$ = 100 µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5 | | | V | $I_E$ = 100 µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | | 100 | nA | $V_{CE}$ = 15 V, Ee = 0 |
| **Coupled** | | | | | | | |
| $I_C/I_F$ | DC Current Transfer Ratio | OPI1264 | 12.5 | | | % | $I_F$ = 10.0 mA, $V_{CE}$ = 5.0 V |
| | | OPI1264A | 25 | | | | |
| | | OPI1264B | 50 | | 125 | | |
| | | OPI1264C | 100 | | | | |
| $V_{ISO}$ | Isolation Voltage | | 10 | | | kVDC | (See Note 1) |
| $V_{CE(SAT)}$ | Collector-Saturation Voltage | | | | 0.40 | V | $I_F$ = 10.0 mA, $I_C$ = 1.6 mA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | | 200 | nA | $I_F$ = 0, $V_{CE}$ = 20 V |

**Typical Performance Curves**

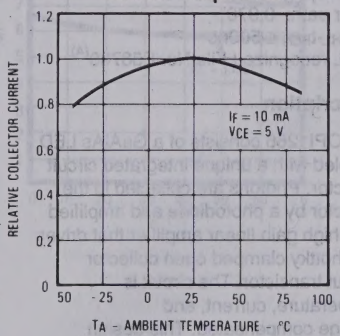
**Collector Current vs Collector-Emitter Voltage**



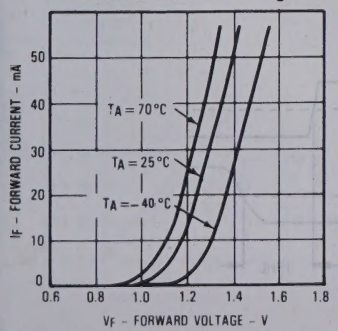

**Relative Collector Current vs Diode Forward Current**



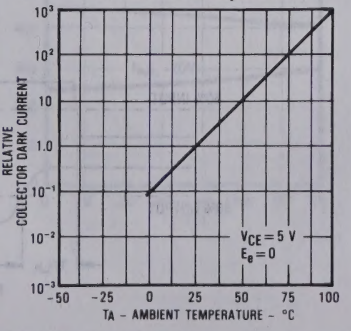

**Relative Collector Current vs Ambient Temperature**



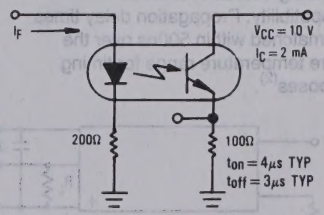

**Diode Forward Current vs Diode Forward Voltage**




**Collector Dark Current vs Ambient Temperature**



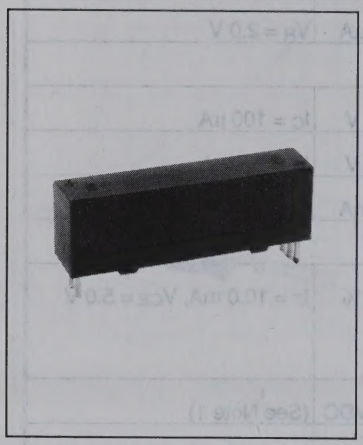

**Switching Time Test Circuit**

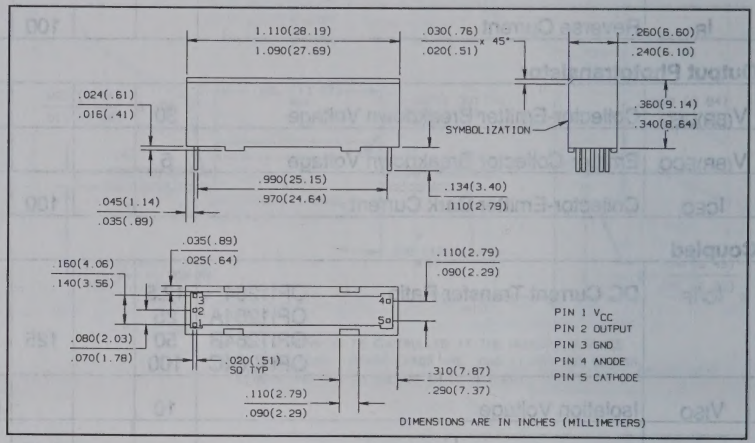



The input waveform is supplied by a generator with the following characteristics: $Z_{OUT}$ = 50Ω, $t_r \leq$ 15 ns, duty cycle ≈ 1%, pulse width ≈ 100 µs.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# High Speed, Very High Voltage Isolator
## Type OPI1266






### Features:

- TTL compatible output
- 16kV Isolation
- 500 kbits/s transfer rate
- Creepage path: 0.970"
- Air path: 0.970"
- $t_{PHL}$-$t_{PLH} \leq 500$ns
- UL recognized File No. E58730(4)

### Description

The OPI1266 consists of a GaAlAs LED coupled with a unique integrated circuit detector. Photons are collected in the detector by a photodiode and amplified by a high gain linear amplifier that drives a Schottky clamped open collector output transistor. The circuit is temperature, current, and voltage compensated. This design produces maximum DC and AC current isolation between input and output while providing TTL/LSTTL circuit compatibility. Propagation delay times are matched within 500ns over the entire temperature range for timing purposes(2).

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | 16kVDC(3)(4) |
| Operating Temperature Range | 0 to + 70°C |
| Storage Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| **Input Diode** | |
| Forward DC Current | 50 mA |
| Reverse Voltage | 2.0V |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Power Dissipation | 100mW |
| **Output IC** | |
| Maximum Supply Voltage | 7.0V |
| Power Dissipation | 100mW |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec max. when flow soldering.
(2) $\Delta T_P = t_{PHL}$-$t_{PLH}$.
(3) Measured with input and output leads shorted. Typical input/output capacitance is 0.05pF.
(4) UL recognition is for 5833 VAC, for 1 minute.

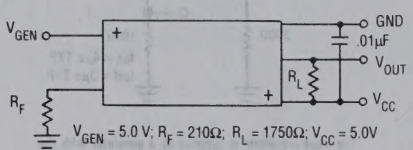



FIG. 1

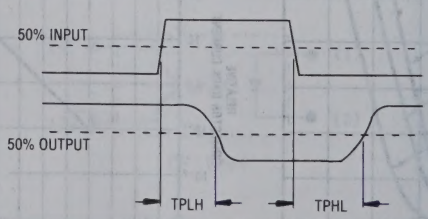



FIG. 2

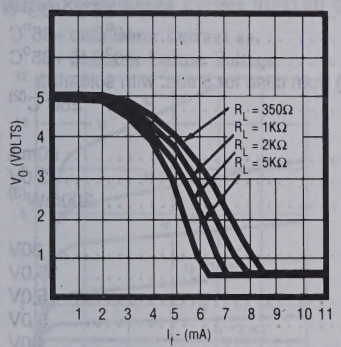
# Type OPI1266

**Electrical Characteristics** ($T_A$ = 0°C to +70°C unless otherwise noted)

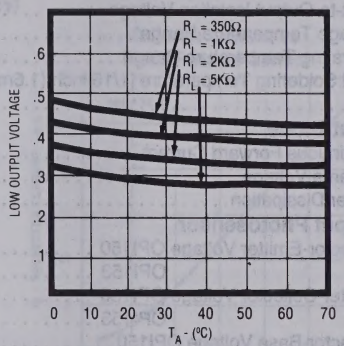
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.8 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Ic** ($V_{CC}$ = 4.75V to 5.25V) | | | | | | |
| $I_{OH}$ | High Level Output Current | | | 100 | µA | $I_F$ = 0, $V_{OUT}$ = 5.5V |
| $V_{OL}$ | Low Level Output Voltage | | | 0.6 | V | $I_F$ = 13.5mA, $I_{OL}$ = 2.6mA |
| $I_{CCH}$ | High Level Supply Current | | | 15 | mA | $I_F$ = 0 |
| $I_{CCL}$ | Low Level Supply Current | | | 18 | mA | $I_F$ = 13.5mA |
| **Coupled** ($V_{CC}$ = 5.0V) | | | | | | |
| $C_{IO}$ | Coupling Capacitance | | | 2.0 | pF | Input & Output Leads Shorted |
| $t_{PLH}$ | Propagation Delay to Low Output Level | | | 800 | ns | See Fig. 1&2 |
| $t_{PHL}$ | Propagation Delay to High Output Level | | | 800 | ns | See Fig. 1&2 |
| $\Delta TP^{(2)}$ | Difference in Propagation Delays | -500 | | 500 | ns | |
| $I_{ISO}$ | Isolation Leakage | | | 1.0 | µA | @ 7kV RMS<br>Input & Output Leads Shorted |

**TYPICAL PERFORMANCE CURVES**

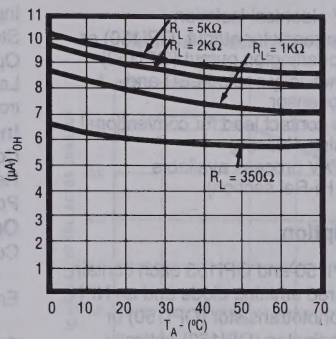
$V_{OUT}$ vs. $I_f$



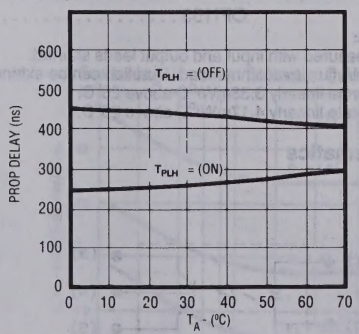

$V_{OL}$ vs. $T_A$




$I_{OH}$ vs. $T_A$

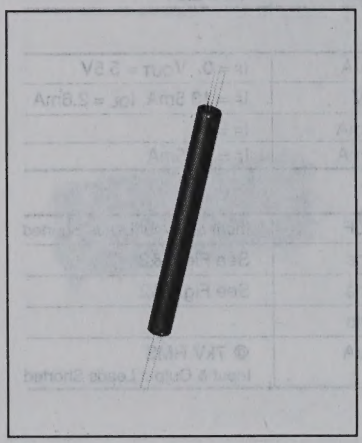


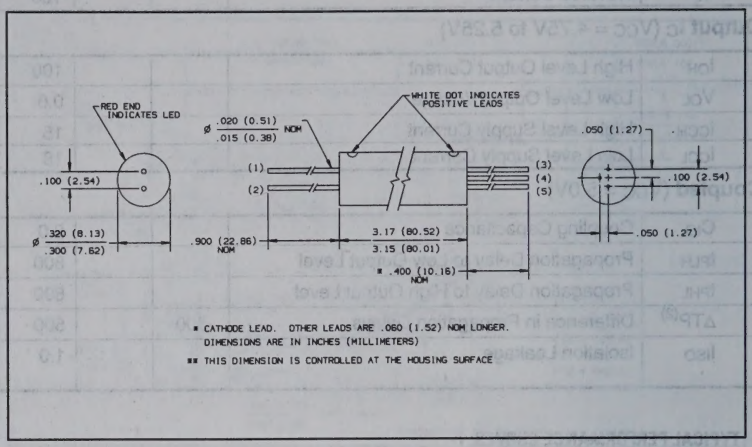

**PROPAGATION DELAY vs. TEMP**




OPTICALLY COUPLED ISOLATORS

# Optically Coupled Isolators
## Types OPI150, OPI153






### Features

- 50kV electrical isolation
- Phototransistor output (OPI150) or photodarlington output (OPI153)
- Hermetically sealed LED and photosensor
- Base contact lead for conventional transistor biasing
- TX-TXV process available (see Hi-Rel section)

### Description

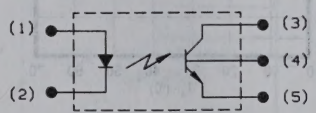
The OPI150 and OPI153 each contain an infrared emitting diode and an NPN silicon phototransistor (OPI150) or photodarlington (OPI153) optically coupled by means of a light pipe and mounted in a high dielectric plastic housing. The LED and sensor are in hermetically sealed packages. These series are designed for applications requiring very high isolation between input and output.

### Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

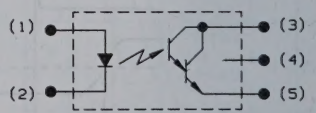
| | |
|---|---|
| Input-to-Output Isolation Voltage | ±50kVDC(1) |
| Storage Temperature Range | -40°C to +85°C |
| Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C(2) |
| **Input Diode** | |
| Continuous Forward Current | 50mA |
| Reverse Voltage | 3.0V |
| Power Dissipation | 200mW(3) |
| **Output Photosensor** | |
| Collector-Emitter Voltage OPI150 | 30V |
| OPI153 | 15.0V |
| Emitter-Collector Voltage OPI150 | 5.0V |
| OPI153 | 5.0V |
| Collector-Base Voltage OPI150 | 30V |
| OPI153 | 20V |
| Power Dissipation OPI150 | 250mW(4) |
| OPI153 | 250mW(4) |

**Notes:**
(1) Measured with input and output leads shorted.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 3.33mW/°C above 25°C.
(4) Derate linearly 4.17mW/°C above 25°C.

### Schematics



OPI150



OPI153

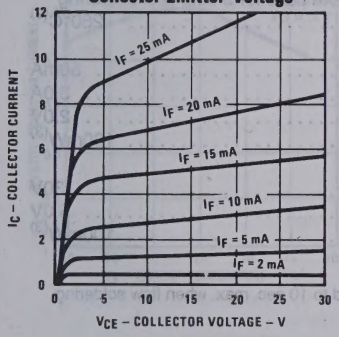
# Types OPI150, OPI153

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

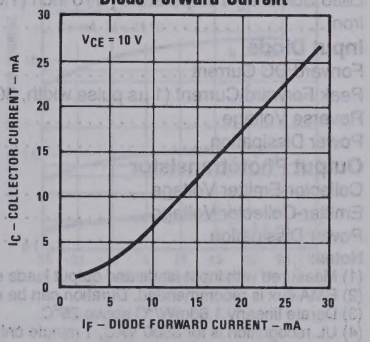
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | OPI150 | | | 1.60 | V | $I_F$ = 50mA |
| | | OPI153 | | | 1.60 | V | $I_F$ = 50mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 3.0V |
| **Output Photosensor** | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | OPI150 | 30 | | | V | $I_C$ = 1.00mA |
| | | OPI153 | 15 | | | V | $I_C$ = 1.00mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | OPI150 | 5 | | | V | $I_F$ = 100µA |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | OPI150 | 30 | | | V | $I_C$ = 100µA |
| | | OPI153 | 20 | | | V | $I_C$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | OPI150 | | | 100 | nA | $V_{CE}$ = 10.0V |
| | | OPI153 | | | 500 | nA | $V_{CE}$ = 10.0V |
| $I_{CBO}$ | Collector-Base Dark Current | OPI150 | | | 50 | nA | $V_{CB}$ = 10.0V |
| **Coupled** | | | | | | | |
| $I_C/I_F$ | DC Current Transfer Ratio | OPI150 | 10 | | | % | $I_F$ = 10mA, $V_{CE}$ = 5.0V |
| | | OPI153 | 25 | | | % | $I_F$ = 20mA, $V_{CE}$ = 5.0V |
| $I_{CB(ON)}$ | On-State Photodiode Current | OPI150 | 10 | | | µA | $I_F$ = 20mA, $V_{CB}$ = 5.0V |
| $V_{CE(SAT)}$ | Saturation Voltage | OPI150 | | | 0.50 | V | $I_F$ = 16.0mA, $I_C$ = 1.0mA |
| | | OPI153 | | | 1.20 | V | $I_F$ = 30.0mA, $I_C$ = 2.0mA |

## Typical Performance Curves (OPI150 Only)

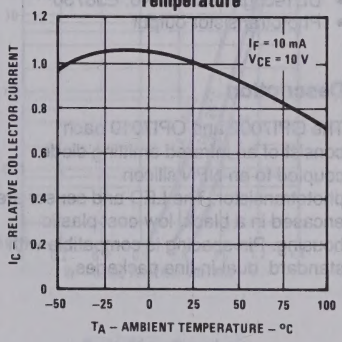
**Collector Current vs. Collector-Emitter Voltage**



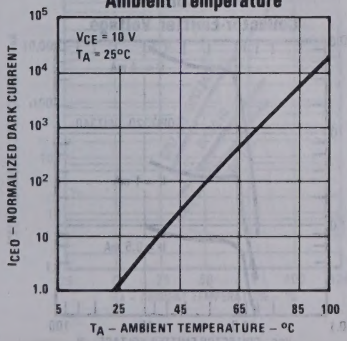

**Collector Current vs. Diode Forward Current**



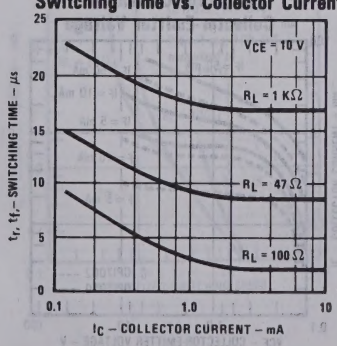

**Relative Collector Current vs. Temperature**



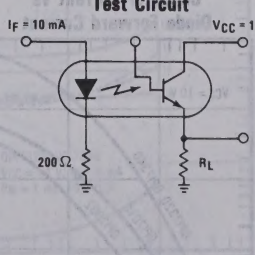

**Normalized Dark Current vs. Ambient Temperature**




**Switching Time vs. Collector Current**




**Test Circuit**



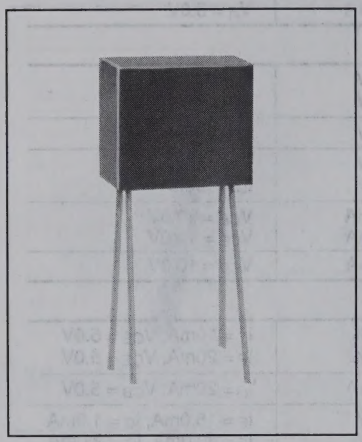

The input waveform is supplied by a generator with the following characteristics: $Z_{OUT}$ = 50Ω, $t_r \leq$ 15 ns. Duty cycle ≈ 1%, pulse width ≈ 100 µ.

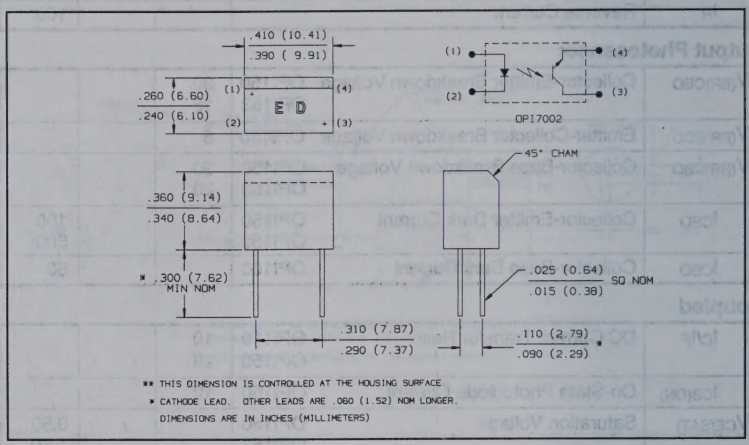


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Optically Coupled Isolators
## Types OPI7002, OPI7010






### Features

- 6kV electrical isolation
- Low cost plastic housing
- UL recognized File No. E58730[4]
- Phototransistor output

### Description

The OPI7002 and OPI7010 each consist of an infrared emitting diode coupled to an NPN silicon phototransistor. The LED and sensor are encased in a black, low-cost plastic housing. Pin spacing is compatible with standard dual-in-line packages.

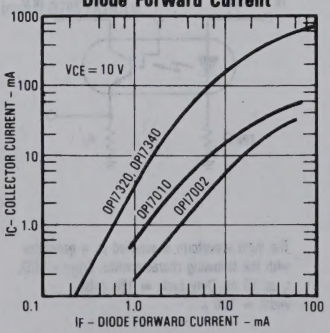
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ± 6kVDC[1][4] |
| Operating and Storage Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C[2] |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse Voltage | 2.0V |
| Power Dissipation | 100mW[3] |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 100mW[3] |

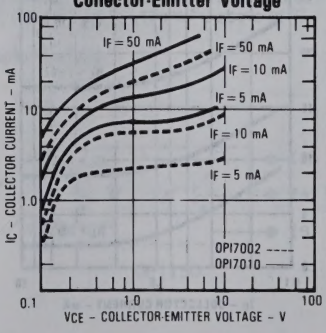
**Notes:**
(1) Measured with input leads and output leads shorted.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 1.66mW/°C above 25°C.
(4) UL recognition is for 3500 VAC, 1 minute only.

### Typical Performance Curves

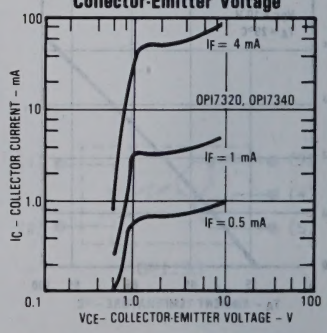
**Collector Current vs Diode Forward Current**




**Collector Current vs Collector-Emitter Voltage**




**Collector Current vs Collector-Emitter Voltage**



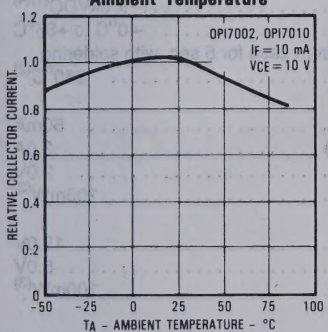
# Types OPI7002, OPI7010

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

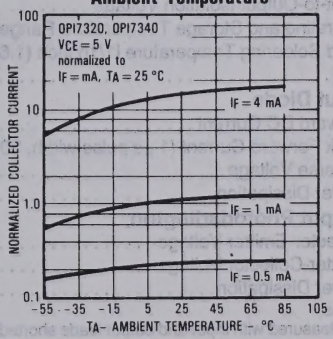
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F$ = 10.0mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30.0 | | | V | $I_C$ = 100µA, $I_F$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | | V | $I_E$ = 100µA, $I_F$ = 0 |
| $I_{CEO}$ | Collector Dark Current | | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0 |
| **Coupled** | | | | | | |
| $I_C/I_F$ | DC Current Transfer Ratio OPI7002<br>OPI7010 | 20<br>100 | | | %<br>% | $I_F$ = 10.0mA, $V_{CE}$ = 5.0V<br>$I_F$ = 10.0mA, $V_{CE}$ = 5.0V |
| $V_{CE}$ | Collector-Emitter Saturation Voltage | | | 0.40 | V | $I_F$ = 10.0mA, $I_C$ = 0.50mA |
| $V_{ISO}$ | Isolation Voltage | 6 | | | kVDC | (See Note 1) |
| $t_{on}$ | Turn-On Time | | 4.0 | | µs | $V_{CE}$ = 10.0V, $I_C$ = 10.0mA, $R_L$ = 100Ω |
| $t_{off}$ | Turn-Off Time | | 3.0 | | µs | $V_{CE}$ = 10.0V, $I_C$ = 10.0mA, $R_L$ = 100Ω |
| $C_{IO}$ | Capacitance Input-to-Output | | 0.20 | | pF | $V_{IO}$ = 0, f = 1MHz(1) |

## Typical Performance Curves

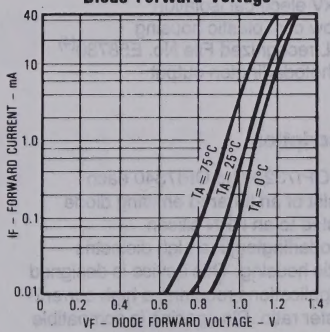
**Relative Collector Current vs Ambient Temperature**



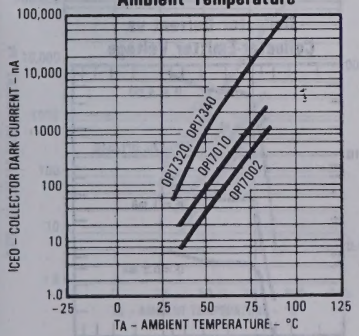

**Normalized Collector Current vs Ambient Temperature**



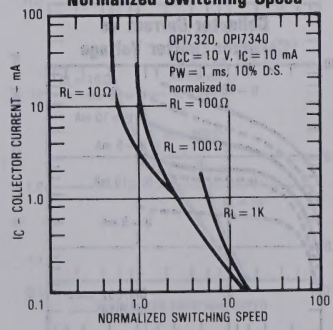

**Diode Forward Current vs Diode Forward Voltage**



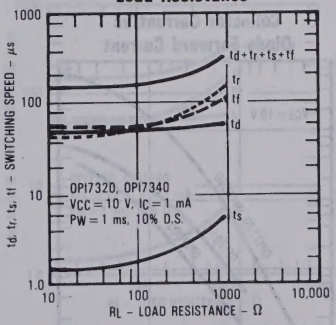

**Collector Dark Current vs Ambient Temperature**




**Collector Current vs Normalized Switching Speed**




**Switching Speed vs Load Resistance**

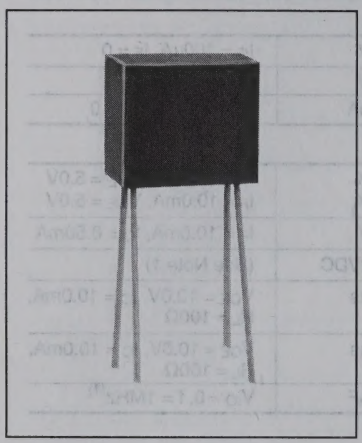


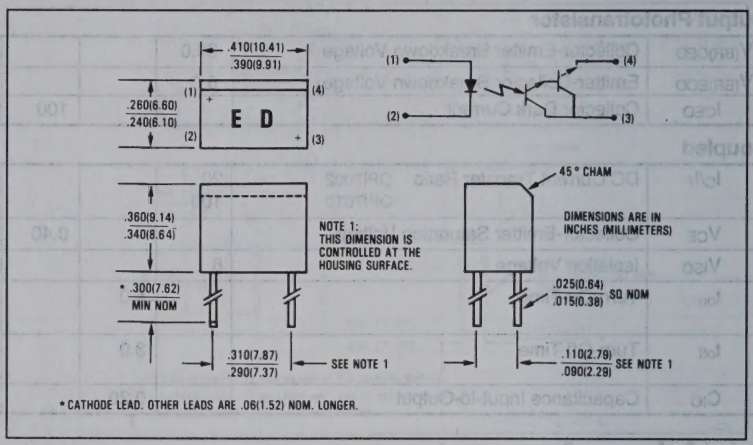

OPTICALLY COUPLED ISOLATORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Optically Coupled Isolators
## Types OPI7320, OPI7340






### Features

- 6kV electrical isolation
- Low cost plastic housing
- UL recognized File No. E58730[4]
- Photodarlington output

### Description

The OPI7320 and OPI7340 each consist of an infrared emitting diode coupled to an NPN silicon photodarlington in a high dielectric plastic housing. This device is designed for applications requiring a high current transfer ratio. Pin spacing is compatible with standard dual-in-line packages.

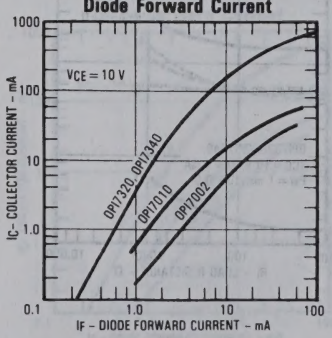
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ± 6kVDC[1][4] |
| Operating and Storage Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 260°C[2] |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse Voltage | 2.0V |
| Power Dissipation | 100mW[3] |
| **Output Photodarlington** | |
| Collector-Emitter Voltage | 15.0V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 100mW[3] |

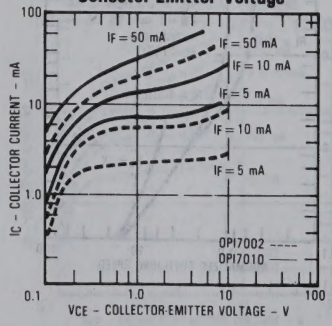
**Notes:**
(1) Measured with input and output leads shorted.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(3) Derate linearly 1.66mW/°C above 25°C.
(4) UL recognition is for 3500 VAC, 1 minute only.

### Typical Performance Curves

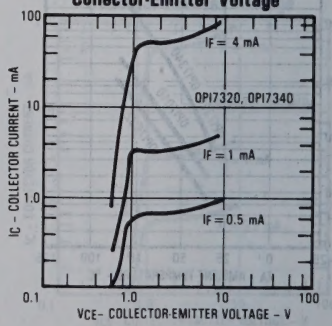
**Collector Current vs Diode Forward Current**




**Collector Current vs Collector-Emitter Voltage**




**Collector Current vs Collector-Emitter Voltage**



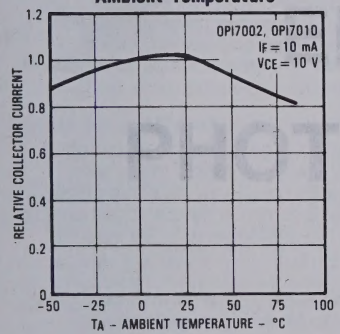
# Types OPI7320, OPI7340

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

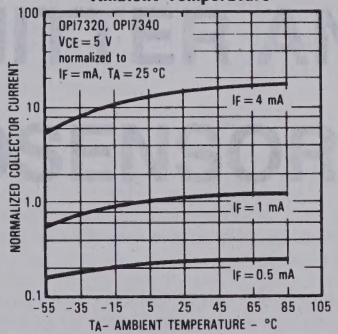
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F$ = 10.0mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Photodarlington** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 15.0 | | | V | $I_C$ = 1.00mA, $I_F$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | | V | $I_E$ = 100µA, $I_F$ = 0 |
| $I_{CEO}$ | Collector Dark Current | | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0 |
| **Coupled** | | | | | | |
| $I_C/I_F$ | DC Current Transfer Ratio OPI7320<br>OPI7340 | 200<br>400 | | | %<br>% | $I_F$ = 5.0mA, $V_{CE}$ = 5.0V<br>$I_F$ = 5.0mA, $V_{CE}$ = 5.0V |
| $V_{(SAT)}$ | Collector-Emitter Saturation Voltage | | | 1.00 | V | $I_F$ = 5.0mA, $I_C$ = 2.0mA |
| $V_{ISO}$ | Isolation Voltage | 6 | | | kVDC | (See Note 1) |
| $t_{on}$ | Turn-On Time | | 150 | | µs | $V_{CE}$ = 10.0V, $I_C$ = 10.0mA, $R_L$ = 100Ω |
| $t_{off}$ | Turn-Off Time | | 125 | | µs | $V_{CE}$ = 10.0V, $I_C$ = 10.0mA, $R_L$ = 100Ω |
| $C_{IO}$ | Capacitance Input-to-Output | | 0.20 | | pF | $V_{IO}$ = 0, f = 1MHz(1) |

## Typical Performance Curves

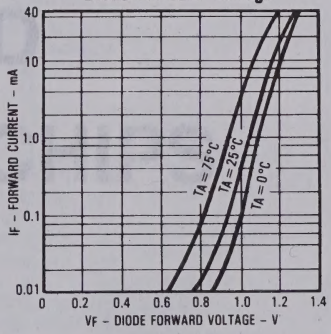
**Relative Collector Current vs Ambient Temperature**



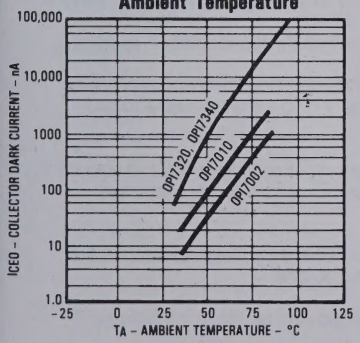

**Normalized Collector Current vs Ambient Temperature**



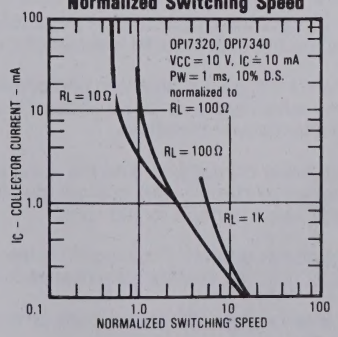

**Diode Forward Current vs Diode Forward Voltage**



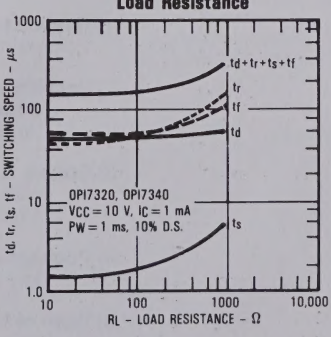

**Collector Dark Current vs Ambient Temperature**




**Collector Current vs Normalized Switching Speed**



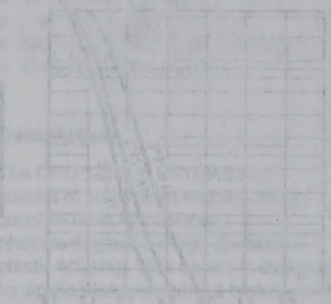

**Switching Speed vs Load Resistance**

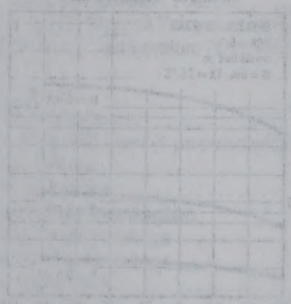


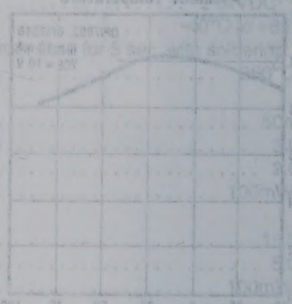

OPTICALLY COUPLED ISOLATORS

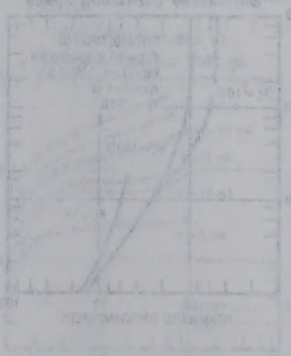
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

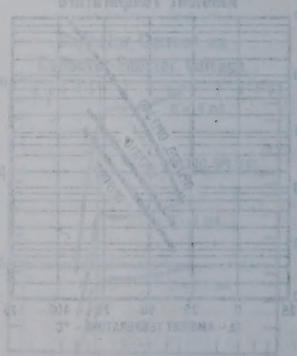
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396











OPTEK® TECHNOLOGY, INC.

# EMITTER AND PHOTOSENSOR CHIPS



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Emitter and Photosensor Chips

Optek Technology, Inc. is widely recognized as one of the industry's leading suppliers of high quality gallium arsenide (GaAs) and gallium aluminum arsenide (GaAlAs) infrared emitter chips and silicon photosensor chips. In hybrid or other applications, where space forbids use of a discrete optoelectronics component, direct placement of emitter and/or sensor chips may be the best alternative. With over twenty years experience, Optek is the technological leader in the design and fabrication of optoelectronic semiconductor chips.

Emitter and sensor chips are manufactured in the closely controlled clean rooms of our headquarters located in Carrollton, Texas. The building was designed and built specifically for the purpose of being used as a semiconductor fabrication facility.

## Emitter Chips Material Fabrication

Two basic types of infrared emitting diode chips are offered by Optek: GaAs or GaAlAs. In the early 1970's, Optron (today known as Optek) pioneered in the development of solution grown epitaxial GaAs IRED's.

## Emitter Chip Selection

GaAs is often chosen for its lower rate of output degradation over time. Throughout their operating lives, crystalline degradation occurs in all III-IV compounds (e.g., GaAs) as micro-flaws propagate due to the combined effects of current and temperature change. Optical efficiency is lowered; hence overall infrared power output drops with time. Heat sinking and careful limiting of operating currents, of course, can have a dramatic effect on the life of the chip. GaAlAs is usually the material of choice when the decision centers upon device efficiency and spectral matching.

The metallization area and chip size are important factors in the IRED output capability. Optek offers smaller chips with smaller metallization areas for low current applications. Typically operated in the range of 10-20 mA, many of these devices may be designed with applications demanding up to 100 mA of forward current. The larger chips with bonding areas designed for high current may be operated at up to five amperes in the pulse mode.

## Photosensor Chip Selection

The basic phototransistor consists of three regions (NPN) with the base (P-type material) acting as receiver of the infrared energy (Figure 2). As such, the bulk of the surface area consists of the base diffusion region to optimize optical collection efficiency. In some chips, the base may also be bonded and electrically biased in order to improve device speed and/or sensitivity. In addition, these products may also be used as PN photodiodes by connecting only the base and collector.

Photodarlington chips are, as expected, more complex than the basic phototransistor. Again, the base region for the photosensitive transistor is designed to be as large as possible to maximize the photosensitive area.

A variety of factors must be considered when choosing the correct chip.

1) **Responsivity:** Photodiodes, particularly PIN structures, offer the highest levels of responsivity in the near infrared wavelengths due to their thicker depletion regions.

2) **Sensitivity:** The current gain available in photodarlingtons and phototransistors produce a sensitivity advantage over photodiodes. Photologic™ chips are available in two levels of radiant power threshold.

3) **Speed:** Due to a lower capacitance and the ability to eliminate the Miller effect associated with the transistor current gain, photodiodes offer superior frequency response. Photologic™ chips perform to 250 kbps.

4) **Package Integration/Volume:** Photologic™ is the choice where package volume is the key factor, combining the functions of several chips into one.

5) **Ease of Logic Interfacing:** With four options on output logic and levels, a Photologic™ chip is the choice.

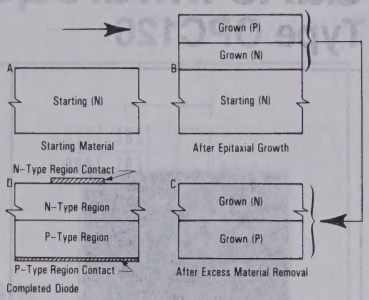
## Chip Mounting and Bonding Recommendations

Two basic mounting (alloy) methods are recommended for the chip products described herein: eutectic and epoxy. Eutectic scrub mounting is most often used with a metal header type of packaging. Solder preforms are required and are commonly available for this type of work. Conductive epoxy (silver based) is generally used when mounting the chip in a silver plated lead frame. Again, these epoxies are commonly available from a variety of suppliers. Mounting to a hybrid ceramic substrate may be accomplished by either of the above methods.

Thermo-compression bonding (ball bonding) is the recommended method of IRED wire bonding. Caution is urged to avoid damage to the delicate chip structure (particularly with GaAs and GaAlAs). The possibility of chip damage should be carefully considered before using ultrasonic, thermo-sonic or other methods. Optek only recommends the use of carefully monitored thermo-compression bonding for gold wire attachment to the metallization area of its IRED chips.

With standard aluminum metallization or all sensor chips, a variety of bonding techniques may be successfully utilized on sensors.

**Figure 1. IRED Chip Fabrication**




## Chip Packaging

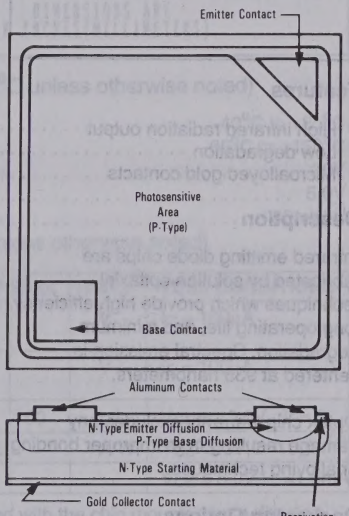
Optek offers three standard methods of packaging chips, in Vials, Tape Pack and Waffle Pack.

**Vial** - This type of packaging is offered for most chips, (very large chips and Photologic-chips are not available in vial packs due to potential damage in shipping). The slice is tested, sawed, sorted, and weigh counted into vials.

**Tape Pack** - A tested slice is mounted on Nitto tape and sawed. This is the least expensive of the three methods

**Waffle Pack** - A slice is tested, sawed on tape and loaded into waffle trays. This is the most expensive of the three methods.

**Figure 2. Typical Phototransistor Layout**




## Optek Hybrid Capability

In many cases, an application demands the use of a hybrid circuit, yet in-house engineering resources and equipment may not be available. Having the chips is only a part of the solution. The investment required to develop the complete hybrid in-house may be unrealistic for many customers.

Optek has a state-of-the-art hybrid facility that may be able to meet your specific needs. Specializing in the automated design and fabrication of complex opto custom hybrid circuits, Optek engineers can solve your most demanding application problems. Many satisfied customers have found that the cost of letting Optek do the entire circuit is often less than the "in-house" approach.

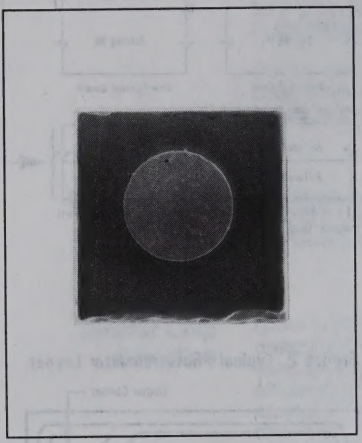
Optek, long known as the leader in custom opto assemblies, is now a leader in opto hybrid design and production. For more information, contact your local Optek sales office.

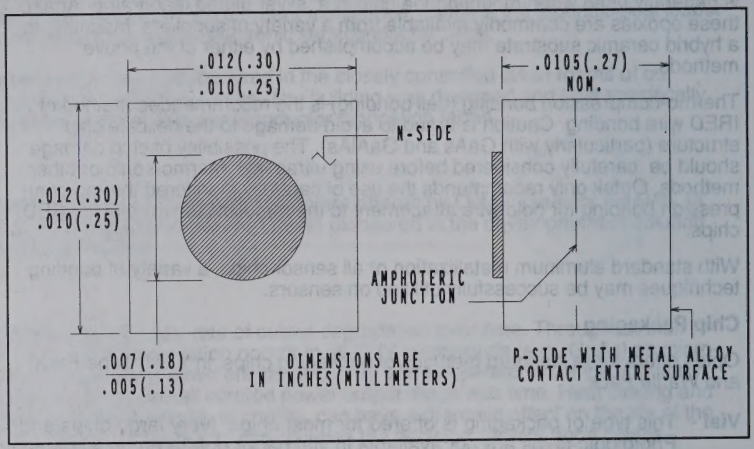


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# GaAs Infrared Emitter Chip
## Type OPC126






### Features

- High infrared radiation output
- Low degradation
- Microalloyed gold contacts

### Description

Infrared emitting diode chips are fabricated by solution epitaxial techniques which provide high efficiency, long operating life, and minimum degradation. Spectral emission is centered at 935 nanometers.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

### Packaging Options

| | |
|---|---|
| OPC126 | Vials |
| OPC126TP | Sawn on Tape |
| OPC126WP | Waffle Pack |

### Replaces

OPC125

### Absolute Maximum Ratings (1) ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -55°C to +150°C |
| Forward DC Current | 150mA(2) |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Power Dissipation | 200mW |

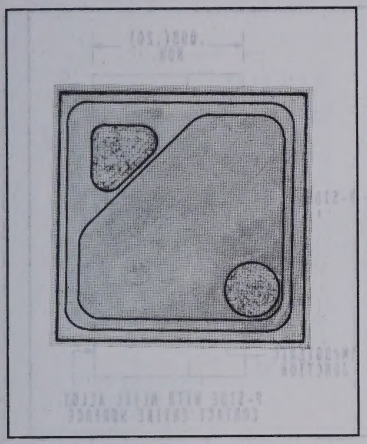
### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

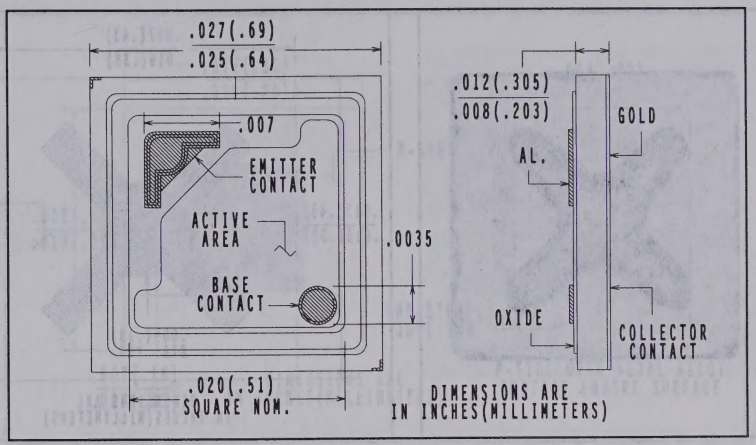
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_R$ | Reverse Voltage | 2.0 | | | V | $I_R$ = 10µA |
| $V_F$ | Forward Voltage | | | 1.75 | V | $I_F$ = 100mA |
| $P_O$ | Radiant Power Output | 2.0 | 4.5 | | mW | $I_F$ = 100mA |

**Notes:** (1) All maximum ratings are determined with the chip mounted on a dimple TO-46 header using Optek techniques. (2) Maximum operating current is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Typical wavelength at peak emission is 935 nm.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# NPN Silicon Phototransistor Chip
## Type OPC200






### Features

- Active area centered on chip
- Low Cost
- Silicon nitride passivation

### Description

Optek Technology photosensor chips are fabricated using the latest silicon planar diffused technology and are silicon nitride passivated for long term stability. All photosensors have an anti-reflective coating over the active area to ensure maximum absorption of irradiated light. Chips can be specially probed for custom requirements.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

### Package Options

OPC200VP Vials
OPC200TP Sawn on Tape
OPC200WP Waffle Pack
OPC200SP Unsawn Slice
Special packaging and testing available upon request. Special transistor arrays available upon request.

### Replaces

OPC600L

### Absolute Maximum Ratings (1) ($T_A$ = 25°C unless otherwise noted)

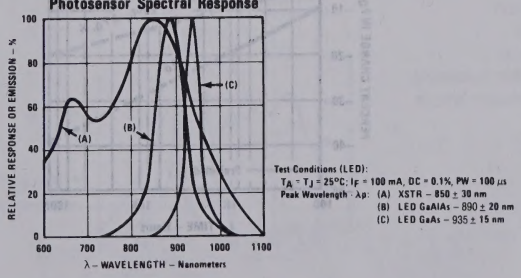
Operating Temperature ..... -40°C to +85°C
Storage Temperature ..... -65°C to +150°C
Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 50mW(2)

### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | 60 | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | 7.5 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector Dark Current | | <1 | 100 | nA | $V_{CE}$ = 10.0V, Φ = 0 |
| $R_\lambda$ | Responsivity | | 0.25 | | A/W | $V_{CE}$=5.0V,Φ=10µW(3) |
| $h_{FE}$ | Current Gain | 100 | | | | $V_{CE}$ = 5.0V,$I_C$ =1.0mA |

**Notes:** (1) All maximum ratings are determined with the chip mounted on a dimpled TO-18 header using Optek techniques. (2) Maximum power dissipation is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Light source is a GaAs LED, $\lambda_P$ = 935nm, typical.

**Typical Performance Curves**

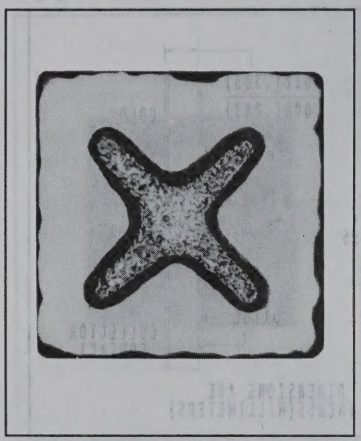


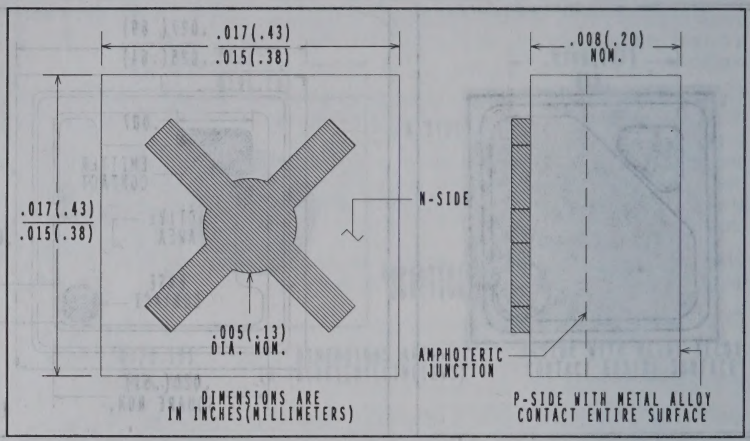

EMITTER & PHOTOSENSOR CHIPS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

# GaAlAs Infrared Emitter Chip
## Type OPC216






### Features

- High infrared radiation output
- Low degradation
- Microalloyed gold contacts

### Description

Infrared emitting diode chips are fabricated by solution epitaxial techniques which provide high efficiency, long operating life, and minimum degradation. Spectral emission is centered at 890 nanometers.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

### Packaging Options

| | |
|---|---|
| OPC216 | Vials |
| OPC216TP | Sawn on Tape |
| OPC216WP | Waffle Pack |

### Absolute Maximum Ratings [1] ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -55°C to +150°C |
| Forward DC Current | 150mA[2] |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Power Dissipation | 200mW |

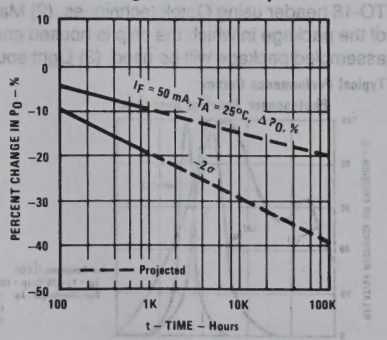
### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_R$ | Reverse Voltage | 2.0 | | | V | $I_R$ = 10µA |
| $V_F$ | Forward Voltage | | | 1.95 | V | $I_F$ = 100mA |
| $P_O$ | Radiant Power Output | 4.0 | 7.5 | | mW | $I_F$ = 100mA[3] |

**Notes:** (1) All maximum ratings are determined with the chip mounted on a dimpled TO-46 header using Optek techniques. (2) Maximum operating current is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Typical wavelength at peak emission is 890 nm.

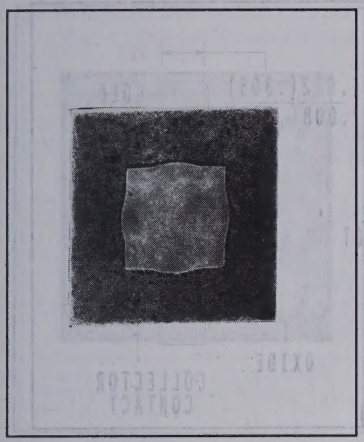
### Typical Performance Curves

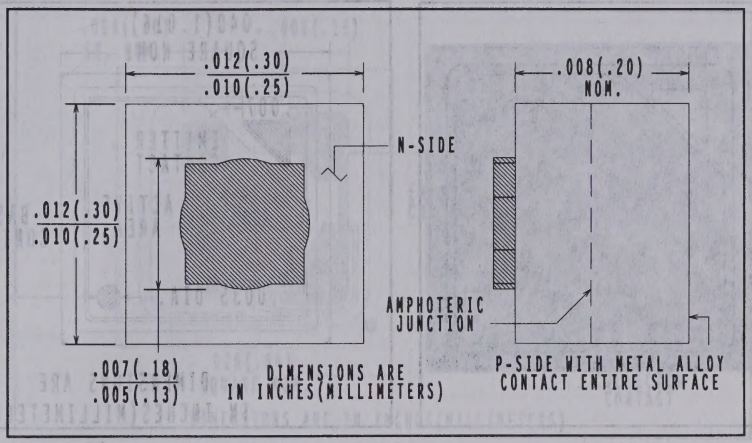
**Percent Change in Power Output vs Time**



OPTEK

# GaAlAs Infrared Emitter Chip
## Type OPC226






### Features

- High infrared radiation output
- Low degradation
- Microalloyed gold contacts

### Description

Infrared emitting diode chips are fabricated by solution epitaxial techniques which provide high efficiency, long operating life, and minimum degradation. Spectral emission is centered at 890 nanometers.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

### Packaging Options

| | |
|---|---|
| OPC226 | Vials |
| OPC226TP | Sawn on Tape |
| OPC226WP | Waffle Pack |

### Replaces

OPC225

### Absolute Maximum Ratings [1] ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -55°C to +150°C |
| Forward DC Current | 150mA[2] |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Power Dissipation | 200mW |

### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_R$ | Reverse Voltage | 2.0 | | | V | $I_R$ = 10µA |
| $V_F$ | Forward Voltage | | | 1.95 | V | $I_F$ = 100mA |
| $P_O$ | Radiant Power Output | 4.0 | 7.5 | | mW | $I_F$ = 100mA[3] |

**Notes:** (1) All maximum ratings are determined with the chip mounted on a dimpled TO-46 header using Optek techniques. (2) Maximum operating current is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Typical wavelength at peak emission is 890 nm.

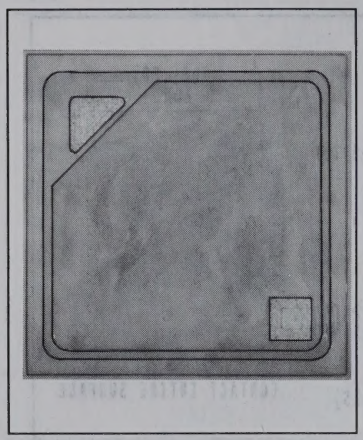


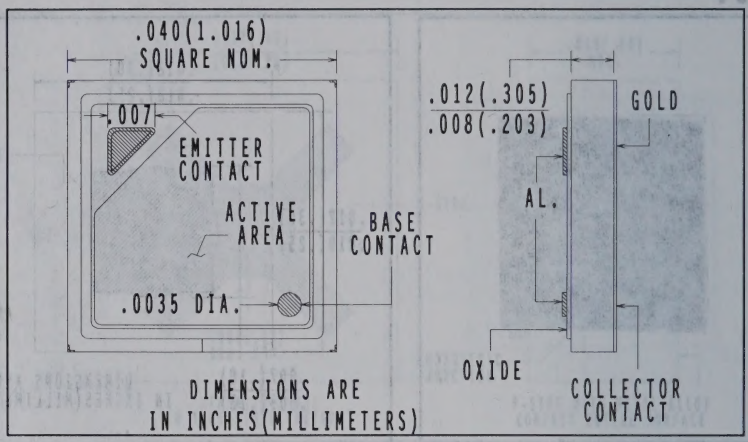
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# NPN Silicon Phototransistor Chip
## Type OPC260






### Features

- 2.7 times the active area of OPC200
- More sensitive at low light levels
- Active area centered on chip

### Description

Optek Technology photosensor chips are fabricated using the latest silicon planar diffused technology and are silicon nitride passivated for long term stability. All photosensors have an anti-reflective coating over the active area to ensure maximum absorption of irradiated light. Chips can be specially probed for custom requirements.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

### Packaging Options

OPC260VP Vials
OPC260TP Sawn on Tape
OPC260WP Waffle Pack
OPC260SP Unsawn Slice
Special packaging and testing available upon request. Special transistor arrays available upon request

### Replaces

OPC60X

### Absolute Maximum Ratings [1] ($T_A$ = 25°C unless otherwise noted)

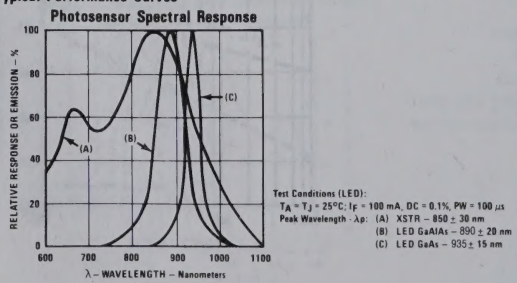
Operating Temperature ..... -40°C to +85°C
Storage Temperature ..... -65°C to +150°C
Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 50mW[2]

### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | 60 | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | 7.5 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector Dark Current | | <1 | 100 | nA | $V_{CE}$ = 10.0V, Φ=0µW |
| $R_\lambda$ | Responsivity | | 0.25 | | A/W | $V_{CE}$=5.0V, Φ=10µW[3] |
| $h_{FE}$ | Current Gain | 50 | | | | $V_{CE}$ = 5.0V, $I_C$ =1mA |

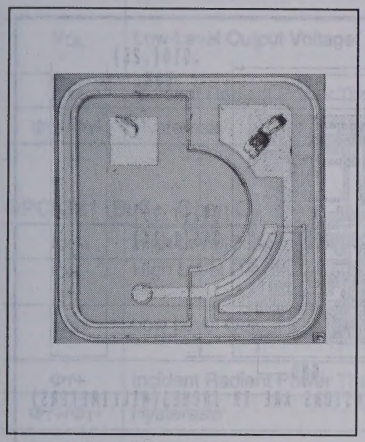
**Notes:** (1) All maximum ratings are determined with the chip mounted on a dimpled TO-18 header using Optek techniques. (2) Maximum power dissipation is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Light source is a GaAs LED, $\lambda_P$ = 935nm, typical.

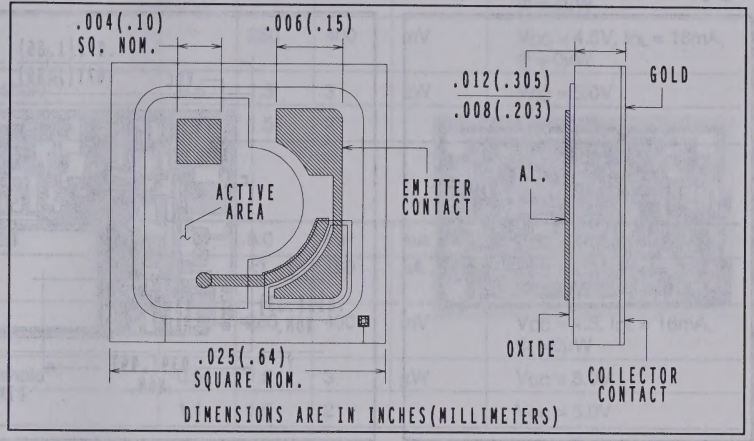
**Typical Performance Curves**



OPTEK

# NPN Silicon Photodarlington Chip
## Type OPC300R






### Features

- High Collector Current
- Improved current sinking characteristics
- Silicon nitride passivation
- Enhanced low current gain

### Description

Optek Technology photosensor chips are fabricated using the latest silicon planar diffused technology and are silicon nitride passivated for long term stability. All photosensors have an anti-reflective coating over the active area to ensure maximum absorption of irradiated light. Bond pads are oxide passivated to protect against mechanical damage.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

### Packaging Options

OPC300RVP Vials
OPC300RTP Sawn on Tape
OPC300RWP Waffle Pack
OPC300RSP Unsawn Slice
Special packaging and testing available upon request.

### Absolute Maximum Ratings (1) ($T_A$ = 25°C unless otherwise noted)

Operating Temperature ..... -40°C to +85°C
Storage Temperature ..... -65°C to +150°C
Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 50mW(2)

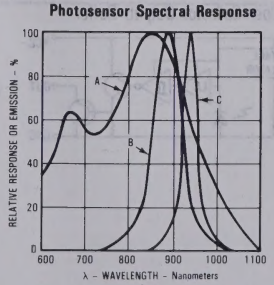
### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | 60 | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 7.0 | 12.5 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector Dark Current | | <10 | 100 | nA | $V_{CE}$=10.0V, Φ=0µW |
| $R_\lambda$ | Responsivity | | 0.2 | | A/W | Φ=10µW(3) |
| $h_{FE}$ | Current Gain | 3K | | | | $V_{CE}$=5.0V, Ib =1.0µA |

**Notes:** (1) All maximum ratings are determined with the chip mounted on a dimpled TO-18 header using Optek techniques. (2) Maximum power dissipation is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Light source is a GaAs LED, $\lambda_P$ = 935nm, typical.

**Typical Performance Curves**

**Photosensor Spectral Response**



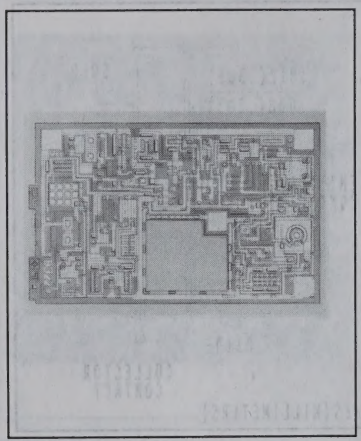

Test Conditions (LED):
$T_A = T_J = 25°C$, $I_F$ = 100 mA, DC = 0.1%, PW = 100 µs
Peak Wavelength - $\lambda_P$: (A) XSTR - 850 ± 30 nm
(B) LED GaAlAs - 890 ± 20 nm
(C) LED GaAs - 935 ± 15 nm

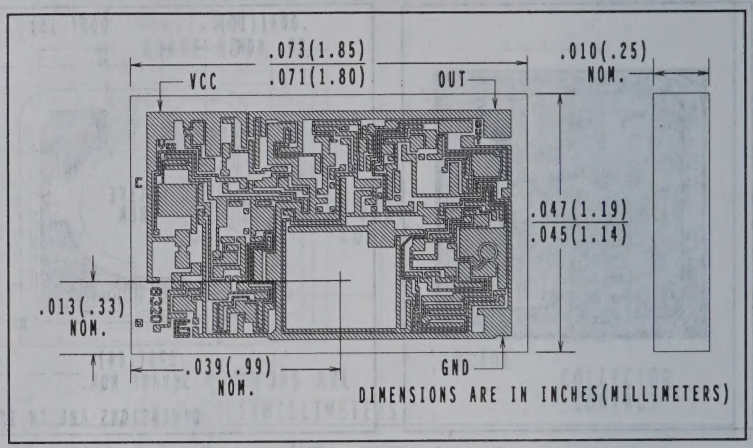
EMITTER & PHOTOSENSOR CHIPS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

# Photologic™ Chips
## Types OPC8320, OPC8321, OPC8322, OPC8323






### Features

- Internal voltage regulator for 4.5V to 18V operation
- Open collector or totem-pole output
- Drive up to 10 TTL loads
- Data rates to 250 kBaud

### Description

The OPC8320 family of photologic chips are bipolar monolithic integrated circuits consisting of a photodiode, a voltage regulator, a linear amplifier, and a Schmitt trigger on a single silicon chip. Four output options are available, buffer-totem pole (OPC8320), buffer-open collector (OPC8321), inverter-open collector (OPC8322), and inverter- totem pole (OPC8323). Featured is logic level output and up to 16mA of sink current for direct driving up to 10 TTL loads. The Schmitt trigger provides hysteresis for high noise immunity.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

### Packaging Options for 8320 Series

OPCXXXXTP Sawn on Tape
OPCXXXXWP Waffle Pack
OPCXXXXSP Unsawn Slice
Special packaging and testing available upon request. Call Optek for availability of other logic chips.

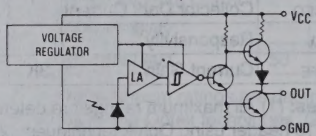
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Operating Temperature | -40°C to +85°C |
| Storage Temperature | -55°C to +125°C |
| Supply Voltage, $V_{CC}$ | 18V |
| Junction Temperature | 125°C |

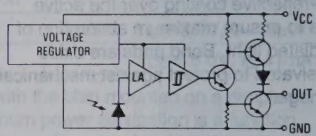
**Notes:** (1) Light level sufficient to cause high level output (see $\Phi_{T+}$). Light source is a GaAs LED, $\lambda_P$ = 935nm. (2) Light level sufficient to cause low level output (see $\Phi_{T-}$). Light source is a GaAs LED, $\lambda_P$ = 935nm, typical.

### Schematics

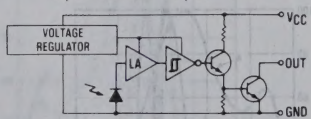
**OPC8320**
(Totem-Pole Output) Buffer



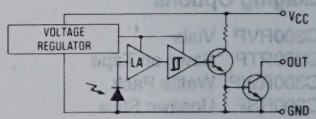

**OPC8323**
(Totem-Pole Output) Inverter




**OPC8321**
(Open-Collector Output) Buffer




**OPC8322**
(Open-Collector Output) Inverter




Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPC8320, OPC8321, OPC8322, OPC8323

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **OPC8320** (Buffer-Totem Pole) | | | | | | |
| $I_{CCH}$ | High Level Supply Current | | 8.0 | 10 | mA | $V_{CC}$ = 18V, Φ = 8μW |
| $V_{OH}$ | High Level Output Voltage | 15.5 | 16.5 | | V | $V_{CC}$ = 18V, $I_{OH}$ = -1.0mA, Φ = 8μW |
| $V_{OL}$ | Low Level Output Voltage | | 280 | 400 | mV | $V_{CC}$ = 4.5V, $I_{OL}$ = 16mA, Φ = 0μW |
| $\Phi_{T+}$ | Incident Radiant Power Threshold[1] | 0.5 | 1.5 | 3 | μW | $V_{CC}$ = 5.0V |
| $\Phi_{T+}/\Phi_{T-}$ | Hysteresis | 1.1 | 1.5 | 2 | | $V_{CC}$ = 5.0V |
| **OPC8321** (Buffer-Open Collector) | | | | | | |
| $I_{CCH}$ | High Level Supply Current | | 8.0 | 10 | mA | $V_{CC}$ = 18V, Φ = 8μW |
| $I_{OH}$ | High Level Output Current | | <1 | 100 | μA | $V_{CC}$ = 18V, $V_{OH}$ = 32V, Φ = 8μW |
| $V_{OL}$ | Low Level Output Voltage | | 280 | 400 | mV | $V_{CC}$ = 4.5, $I_{OL}$ = 16mA, Φ = 0μW |
| $\Phi_{T+}$ | Incident Radiant Power Threshold[1] | 0.5 | 1.5 | 3 | μW | $V_{CC}$ = 5.0V |
| $\Phi_{T+}/\Phi_{T-}$ | Hysteresis | 1.1 | 1.5 | 2 | | $V_{CC}$ = 5.0V |
| **OPC8322** (Inverter-Open Collector) | | | | | | |
| $I_{CCL}$ | Low Level Supply Current | | 8 | 10 | mA | $V_{CC}$ = 18V, Φ = 0μW |
| $I_{OH}$ | High Level Output Current | | <1 | 15 | μA | $V_{CC}$ = 18V, $V_{OH}$ = 32V, Φ = 0μW |
| $V_{OL}$ | Low Level Output Voltage | | 280 | 400 | mV | $V_{CC}$ = 4.5, $I_{OL}$ = 16mA, Φ = 8μW |
| $\Phi_{T-}$ | Incident Radiant Power Threshold[2] | 0.5 | 1.5 | 3 | μW | $V_{CC}$ = 5.0V |
| $\Phi_{T-}/\Phi_{T+}$ | Hysteresis | 1.1 | 1.5 | 2 | | $V_{CC}$ = 5.0V |
| **OPC8323** (Inverter-Totem Pole) | | | | | | |
| $I_{CCH}$ | High Level Supply Current | | 8.0 | 10 | mA | $V_{CC}$ = 18V, Φ = 0μW |
| $V_{OH}$ | High Level Output Voltage | 15.5 | 16.5 | | V | $V_{CC}$ = 18, $I_{OH}$ = -1.0mA, Φ = 0μW |
| $V_{OL}$ | Low Level Output Voltage | | 280 | 400 | mV | $V_{CC}$ = 4.5, $I_{OH}$ = 16mA, Φ = 8μW |
| $\Phi_{T-}$ | Incident Radiant Power Threshold[2] | 0.5 | 1.5 | 3 | μW | $V_{CC}$ = 5.0V |
| $\Phi_{T-}/\Phi_{T+}$ | Hysteresis | 1.1 | 1.5 | 2 | | $V_{CC}$ = 5.0V |

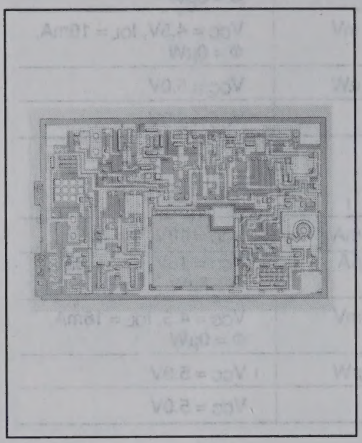


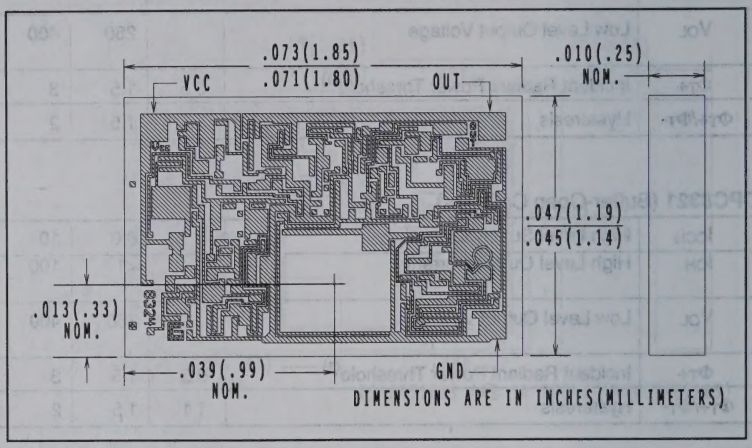
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# Photologic™ Chips
## Types OPC8324, OPC8325, OPC8326, OPC8327






### Features

- Internal voltage regulator for 4.5V to 18V operation
- Open collector or totem-pole output
- Drive up to 10 TTL loads
- Data rates to 250 kBaud
- High sensitivity

### Description

The OPC8324 family of photologic chips are bipolar monolithic integrated circuits consisting of a photodiode, a voltage regulator, a linear amplifier, and a Schmitt trigger on a single silicon chip. Four output options are available, buffer-totem pole (OPC8324), buffer-open collector (OPC8325), inverter-open collector (OPC8326), and inverter- totem pole (OPC8327). The OPC8324 family features significantly lower thresholds than the companion OPC8320 family.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

### Packaging Options for 8324 Series

OPC8XXXTP Sawn on Tape
OPC8XXXWP Waffle Pack
OPC8XXXSP Unsawn Slice
Special packaging and testing available upon request. Call Optek for availability of other logic chips.

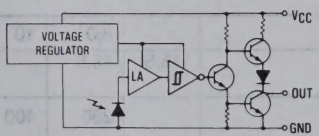
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Operating Temperature ..... -40°C to +85°C
Storage Temperature ..... -55°C to +125°C
Supply Voltage, $V_{CC}$ ..... 18V
Junction Temperature ..... 125°C

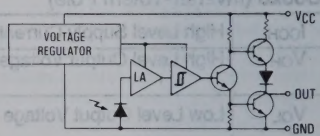
**Notes:** (1) Light level sufficient to cause high level output (see $\Phi_T$+). Light source is a GaAs LED, $\lambda_P$ = 935nm. (2) Light level sufficient to cause low level output (see $\Phi_T$-). Light source is a GaAs LED, $\lambda_P$ = 935nm, typical.

### Schematics

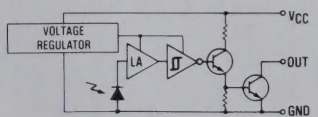
**OPC8324**
(Totem-Pole Output) Buffer



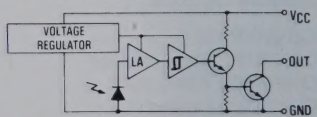

**OPC8327**
(Totem-Pole Output) Inverter




**OPC8325**
(Open-Collector Output) Buffer




**OPC8326**
(Open-Collector Output) Inverter



# Types OPC8324, OPC8325, OPC8326, OPC8327

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

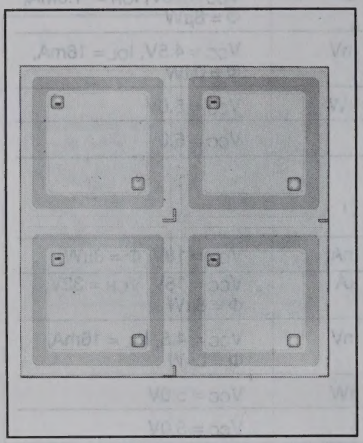
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **OPC8324** (Buffer-Totem Pole) | | | | | | |
| $I_{CCH}$ | High Level Supply Current | | 8.0 | 10 | mA | $V_{CC}$ = 18V, Φ = 8μW |
| $V_{OH}$ | High Level Output Voltage | 15.5 | 16.5 | | V | $V_{CC}$ = 18V, $I_{OH}$ = -1.0mA, Φ = 8μW |
| $V_{OL}$ | Low Level Output Voltage | | 280 | 400 | mV | $V_{CC}$ = 4.5V, $I_{OL}$ = 16mA, Φ = 0μW |
| $Φ_{T+}$ | Incident Radiant Power Threshold(1) | 0.1 | 0.7 | 1.5 | μW | $V_{CC}$ = 5.0V |
| $Φ_{T+}/Φ_{T-}$ | Hysteresis | 1.1 | 1.5 | 2 | | $V_{CC}$ = 5.0V |
| **OPC8325** (Buffer-Open Collector) | | | | | | |
| $I_{CCH}$ | High Level Supply Current | | 8.0 | 10 | mA | $V_{CC}$ = 18V, Φ = 8μW |
| $I_{OH}$ | High Level Output Current | | <1 | 100 | μA | $V_{CC}$ = 18V, $V_{OH}$ = 32V, Φ = 8μW |
| $V_{OL}$ | Low Level Output Voltage | | 280 | 400 | mV | $V_{CC}$ = 4.5, $I_{OL}$ = 16mA, Φ = 0μW |
| $Φ_{T+}$ | Incident Radiant Power Threshold(1) | 0.1 | 0.7 | 1.5 | μW | $V_{CC}$ = 5.0V |
| $Φ_{T+}/Φ_{T-}$ | Hysteresis | 1.1 | 1.5 | 2 | | $V_{CC}$ = 5.0V |
| **OPC8326** (Inverter-Open Collector) | | | | | | |
| $I_{CCL}$ | Low Level Supply Current | | 8 | 10 | mA | $V_{CC}$ = 18V, Φ = 0μW |
| $I_{OH}$ | High Level Output Current | | <1 | 15 | μA | $V_{CC}$ = 18V, $V_{OH}$ = 32V, Φ = 0μW |
| $V_{OL}$ | Low Level Output Voltage | | 280 | 400 | mV | $V_{CC}$ = 4.5, $I_{OL}$ = 16mA, Φ = 8μW |
| $Φ_{T-}$ | Incident Radiant Power Threshold(2) | 0.1 | 0.7 | 1.5 | μW | $V_{CC}$ = 5.0V |
| $Φ_{T-}/Φ_{T+}$ | Hysteresis | 1.1 | 1.5 | 2 | | $V_{CC}$ = 5.0V |
| **OPC8327** (Inverter-Totem Pole) | | | | | | |
| $I_{CCH}$ | High Level Supply Current | | 8.0 | 10 | mA | $V_{CC}$ = 18V, Φ = 0μW |
| $V_{OH}$ | High Level Output Voltage | 15.5 | 16.5 | | V | $V_{CC}$ = 18, $I_{OH}$ = -1.0mA, Φ = 0μW |
| $V_{OL}$ | Low Level Output Voltage | | 280 | 400 | mV | $V_{CC}$ = 4.5, $I_{OH}$ = 16mA, Φ = 8μW |
| $Φ_{T-}$ | Incident Radiant Power Threshold(2) | 0.1 | 0.7 | 1.5 | μW | $V_{CC}$ = 5.0V |
| $Φ_{T-}/Φ_{T+}$ | Hysteresis | 1.1 | 1.5 | 2 | | $V_{CC}$ = 5.0V |

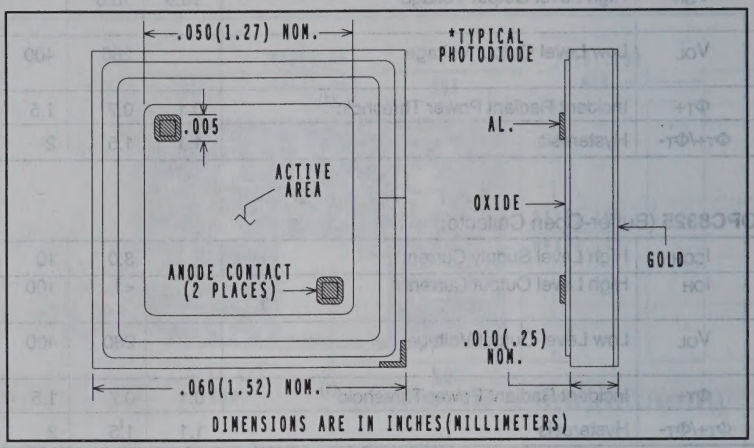


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# PN Photodiodes
## Type OPC9XXX






### Features

- PN photodiode elements
- Silicon nitride passivation anti-reflective coating

### Description

Multi-element arrays are recommended for a variety of motion sensing and control applications ranging from encoding to quadrant sensing. Optek's photodiodes may be operated from zero bias (photovoltaic) up to the diode's reverse breakdown voltage.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

### Packaging Options

OPC9XXXTP Sawn on Tape
OPC9XXXWP Waffle Pack
OPC9XXXSP Unsawn Slice
Special packaging and testing available upon request.

### Absolute Maximum Ratings[1] ($T_A$ = 25°C unless otherwise noted)

Operating Temperature ..... -40°C to +85°C
Storage Temperature ..... -65°C to +150°C
Reverse Breakdown Voltage ..... 30V
Power Dissipation ..... 150mW[2]

**Electrical Characteristics Per Element** ($T_A$ = 25°C unless otherwise noted)

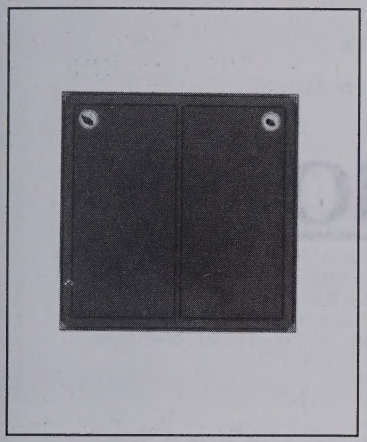
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_{(BR)R}$ | Reverse Breakdown Voltage | 30 | 80 | | V | $I_R$ = 100µA |
| $I_D$ | Reverse Dark Current | | <1 | 15 | nA | $V_R$ = 10V |
| $R_\lambda$ | Responsivity | 0.45 | 0.50 | | A/W | Φ = 10µW[3] |
| $C_T$ | Capacitance per sq. mil | | 0.03 | | pF | $V_R$ =1V, Φ = 0µW |

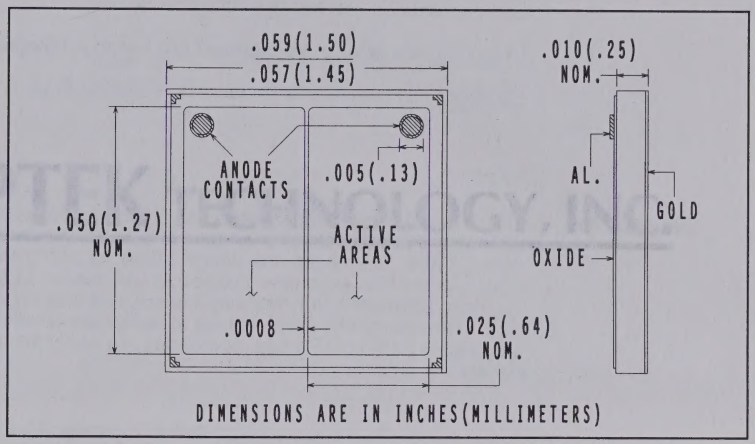
**Notes:** (1) All maximum ratings are determined with the chip mounted on a TO-15 header using Optek techniques. (2) Maximum power dissipation is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Light source is a GaAs LED, $\lambda_P$ = 935nm, typical.

| Photodiodes Available | |
|---|---|
| **Part Number** | **Sizes** |
| OPC910 | 0.050 X 0.050 inches |
| OPC911 | 0.060 X 0.060 inches (2 X 2 Array) |
| OPC915 | 0.120 X 0.120 inches |
| OPC925 | 0.040 X 0.040 inches |
| OPC9013 | 0.210 X 0.210 inches |
| Other sizes available | |

OPTEK

# Dual Element Silicon PN Photodiode
## Type OPC922






### Features

- 25 mil x 50 mil PN photodiode elements
- Silicon nitride passivation
- Anti-reflective coating

### Description

Dual photodiodes are useful in a variety of motion sensing and control applications ranging from encoding to position sensing. Optek's photodiodes may be operated from zero bias (photovoltaic) up to the diode's reverse breakdown voltage.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

### Packaging Options

OPC922TP Sawn on Tape
OPC922WP Waffle Pack
OPC922SP Unsawn Slice
Special packaging and testing available upon request.

### Absolute Maximum Ratings[1] ($T_A$ = 25°C unless otherwise noted)

Operating Temperature ..... -40°C to +85°C
Storage Temperature ..... -65°C to +120°C
Reverse Breakdown Voltage ..... 40V
Power Dissipation..... 150mW[2]

**Electrical Characteristics Per Element** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $V_{(BR)R}$ | Reverse Breakdown Voltage | 40 | 70 | | V | $I_R$ = 100µA |
| $I_D$ | Reverse Dark Current | | <1 | 10 | nA | $V_R$ = 15V |
| $R_\lambda$ | Responsivity | 0.35 | 0.5 | | A/W | $\Phi$ = 10µW, $V_R$=0V[3] |
| $C_T$ | Capacitance | | 50 | | pF | $V_R$ =01V, $\Phi$ = 0 |

**Notes:** (1) All maximum ratings are determined with the chip mounted on a TO-15 header using Optek techniques. (2) Maximum power dissipation is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Light source is a GaAs LED, $\lambda_P$ = 935nm, typical.

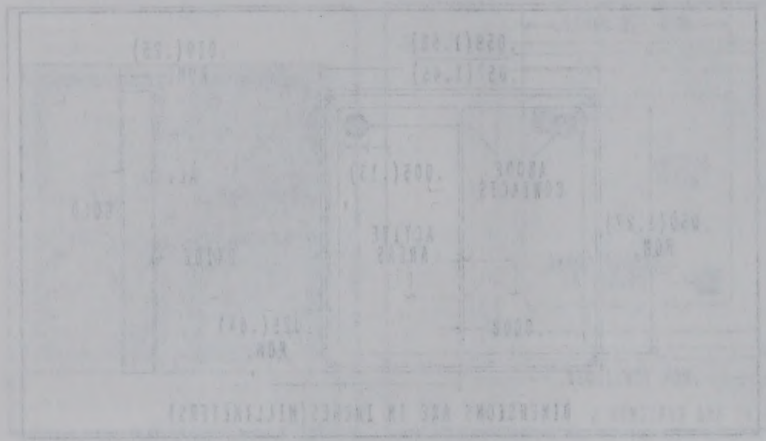


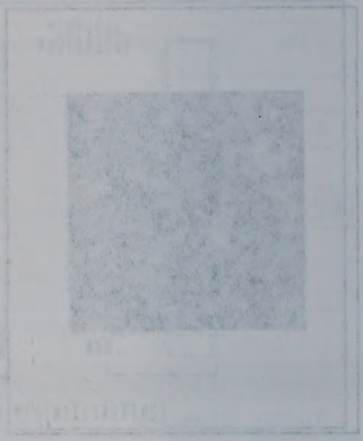
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

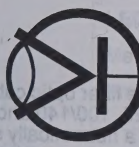
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Dual Element Silicon PN Photodiode

## Type OPC9XXX







OPTEK® TECHNOLOGY, INC.

# FIBER OPTIC COMPONENTS



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Fiber Optics

**Features**

LED coupled power 89 µW into 62.5 micron fiber.

Low capacitance, low leakage PIN photodiodes.

Components available pre-mounted and tested in receptacles.

Packages compatible with standard receptacles, SMA, ST*, and others.

**Description**

The Optek fiber optic components are optomized for use with multimode fiber optic cable at 850nm. The optical design provides good coupling with 50/125, 62.5/125, 100/140 and larger optical fibers. The mechanical design offers the user a choice between a hermetically sealed device, and a less expensive plastic cap component. LED's and PIN diodes are subjected to testing to eliminate infant mortality failures, and thus improve field reliability. Performances tests are accomplished with as near to actual use conditions as possible. Devices which are mounted in SMA or ST* style receptacles are easily mounted to printed circuit boards or panels.

**LED Burn-in**

All LED's are subjected to 100% burn-in testing. Test conditions are: 96 hours at 100mA, continuous current in 25° C ambient.

**Why Use Fiber Optics**

Electrical Isolation

EMI Immunity

Increased Bandwidth

Low Loss

Reduced Size, Weight

Secure Transmission

Lower Material Cost

**Applications**

System operating in high EMI or RFI ambients.

Explosive environments such as found in the petroleum/chemical processing or mining industries.

Optical coupling where high isolation voltage is required.

Secure communications.

Local area networks.

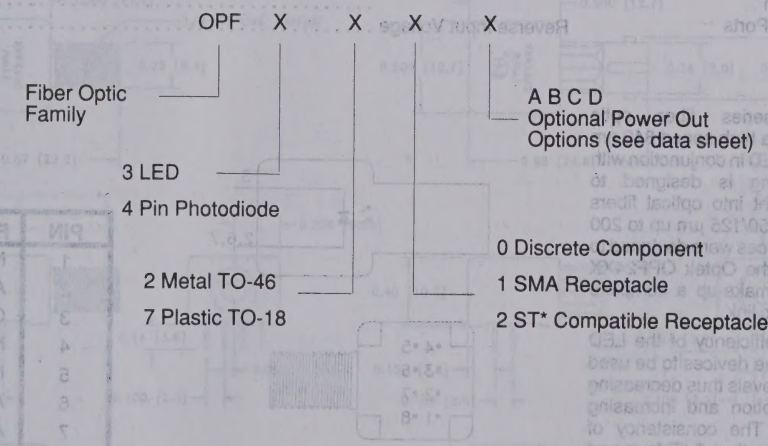
*ST is a registered trademark of AT&T

## Part Number System

| | Discrete Component | Mounted in SMA Receptacle | Mounted in ST* Compatible Receptacle |
|---|---|---|---|
| **LED** | | | |
| Metal Package | OPF320X | OPF321X | OPF322X |
| Plastic Package | OPF370X | OPF371X | OPF372X |
| **PIN PHOTODIODE** | | | |
| Metal Package | OPF420 | OPF421 | OPF422 |
| Plastic Package | OPF470 | OPF471 | OPF472 |

Metal Package, TO-46 Hermetic Sealed

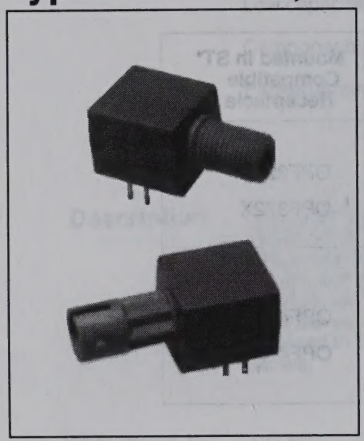
Plastic Package, TO-18

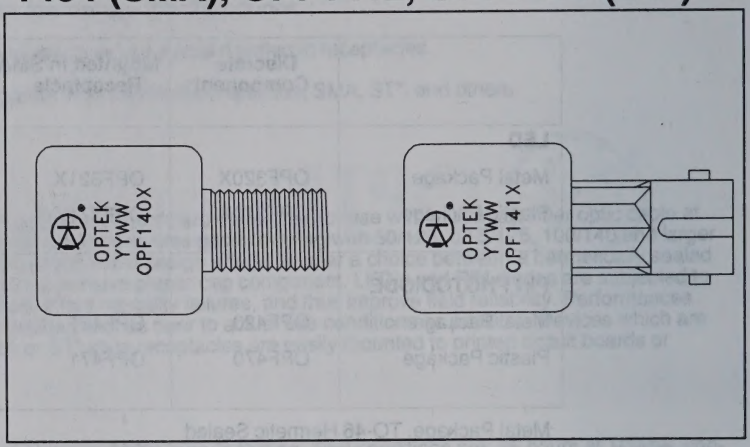



*ST is a registered trademark of AT&T

FIBER OPTIC COMPONENTS

# High Speed Fiber Optic Transmitter
## Types OPF1402, OPF1404 (SMA), OPF1412, OPF1414 (ST*)






### Features

- Low Cost
- High Speed
- No Mounting Hardware Required
- Wide Temperature Range
- 100% LED Burn-In
- SMA or ST* Style Ports
- Wave Solderable

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature | -55°C to +85°C |
| Operating Temperature | -40°C to +85°C |
| Lead Soldering Temperature | 260°C(10 sec) |
| Forward Input Current | Peak 200mA |
| | DC 100mA |
| Reverse Input Voltage | 1.8V |

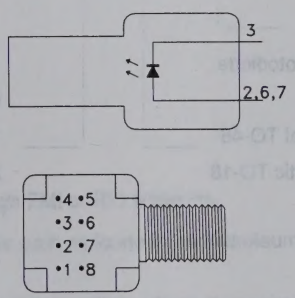
### Description

The OPF14XX series fiber optic transmitters contain a high speed 840 nm GaAlAs LED. This LED in conjunction with the package lensing is designed to efficiently couple light into optical fibers ranging in size from 50/125 µm up to 200 µm PCS. These devices were designed to work together with the Optek OPF24XX series receivers to make-up a complete high speed fiber optic link.

The high coupling efficiency of the LED and lensing allows the devices to be used at low current drive levels thus decreasing the power consumption and increasing system reliability. The consistency of coupling varies by less than 5 dB from part to part which reduces the dynamic range requirements of the receiver.

The high power (-16.5 dBm into 50/125 µm) OPF14X4 was designed for small fiber applications or where there are large fixed losses such as in systems that contain star couplers or in line connectors. The OPF14X2 (-11.5 dBm optical power) is ideal for 100/140 µm fiber applications.

*ST is a registered trademark of AT&T.




**Bottom View**

| PIN | FUNCTION |
|---|---|
| 1 | N.C. |
| 2 | Anode |
| 3 | Cathode |
| 4 | N.C. |
| 5 | N.C. |
| 6 | Anode |
| 7 | Anode |
| 8 | N.C. |

# Types OPF1402, OPF1404 (SMA), OPF1412, OPF1414 (ST*)

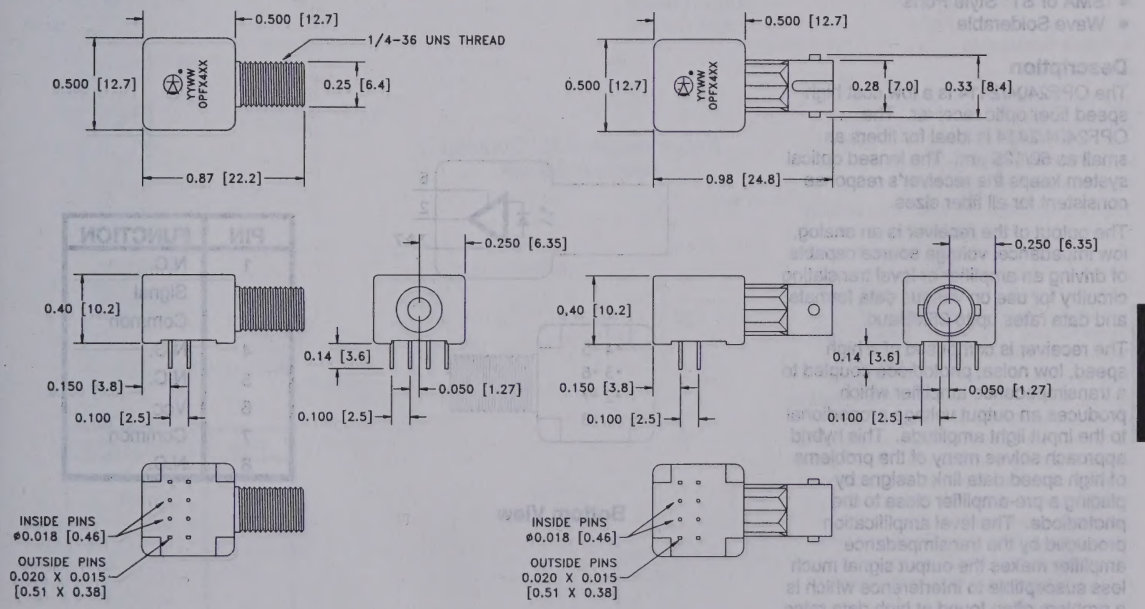
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNIT | TEST CONDITION |
|---|---|---|---|---|---|---|
| $V_F$ | Forward Voltage | 1.48 | 1.70 | 2.09 | V | $I_F$ = 60 mA, $T_A$ = -40°C to +85°C |
| $V_{BR}$ | Reverse Input Voltage | 1.8 | 3.8 | | V | $I_R$ = 100 µA, $T_A$ = -40°C to +85°C |
| $\lambda_P$ | Peak Emission Wavelength | | 840 | | nm | $I_F$ = 60 mA |

**Peak Output Optical Power Measured Through 1 m of Cable**

| SYMBOL | PARAMETER | 1412/1402 | | | 1414/1404 | | | UNIT | TEST CONDITION |
|---|---|---|---|---|---|---|---|---|---|
| | | MIN | TYP | MAX | MIN | TYP | MAX | | |
| $P_{T100}$ | 100/140 µm Fiber Cable N.A. = 0.30 | -15.0 | -12.0 | -9.5 | -10.0 | -6.5 | -4.5 | dBm | $I_F$ = 60 mA |
| $P_{T62}$ | 62.5/125 µm Fiber Cable N.A. = 0.27 | -19.0 | -16.0 | -14.0 | -15.0 | -12.0 | -10.0 | dBm | $I_F$ = 60 mA |
| $P_{T50}$ | 50/125 µm Fiber Cable N.A. = 0.18 | -22.5 | -19.5 | -17.5 | -19.5 | -16.5 | -14.5 | dBm | $I_F$ = 60 mA |
| $t_r$, $t_f$ | Rise Time, Fall Time (10% to 90%) | | 4.0 | 6.5 | | 4.0 | 6.5 | ns | $I_F$ = 60 mA, No pre-bias |

**Mechanical Dimensions**



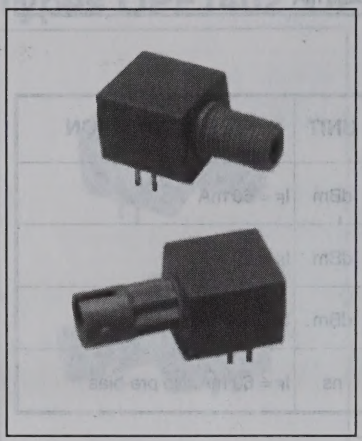

DIMENSIONS ARE IN INCHES (MILLIMETERS)

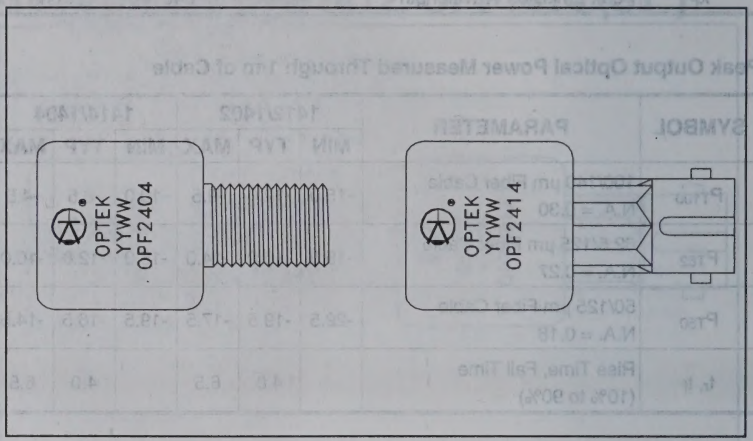


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# 25 MHz Fiber Optic Receiver
## Types OPF2404(SMA), OPF2414(ST*)






### Features

- Low Cost
- No Mounting Hardware Required
- Wide Temperature Range
- Link Distances up to 4 KM
- SMA or ST* Style Ports
- Wave Solderable

### Description

The OPF2404/2414 is a low cost high speed fiber optic receiver. The OPF2404/2414 is ideal for fibers as small as 50/125 µm. The lensed optical system keeps the receiver's response consistent for all fiber sizes.

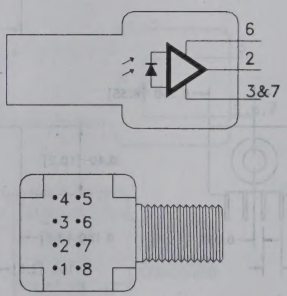
The output of the receiver is an analog, low impedance, voltage source capable of driving an amplifier or level translating circuitry for use on various data formats and data rates up to 35MBaud.

The receiver is comprised of a high speed, low noise, photodiode coupled to a transimpedance amplifier which produces an output voltage proportional to the input light amplitude. This hybrid approach solves many of the problems of high speed data link designs by placing a pre-amplifier close to the photodiode. The level amplification produced by the transimpedance amplifier makes the output signal much less susceptible to interference which is a problem often found at high data rates and in high EMI environments.

*ST is a registered trademark of AT&T.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature | -55°C to +85°C |
| Operating Temperature | -40°C to +85°C |
| Lead Soldering Temperature (for 10 sec.) | 260°C |
| Supply Voltage | -0.5 to 7.0V |




Bottom View

| PIN | FUNCTION |
|---|---|
| 1 | N.C. |
| 2 | Signal |
| 3 | Common |
| 4 | N.C. |
| 5 | N.C. |
| 6 | Vcc |
| 7 | Common |
| 8 | N.C. |

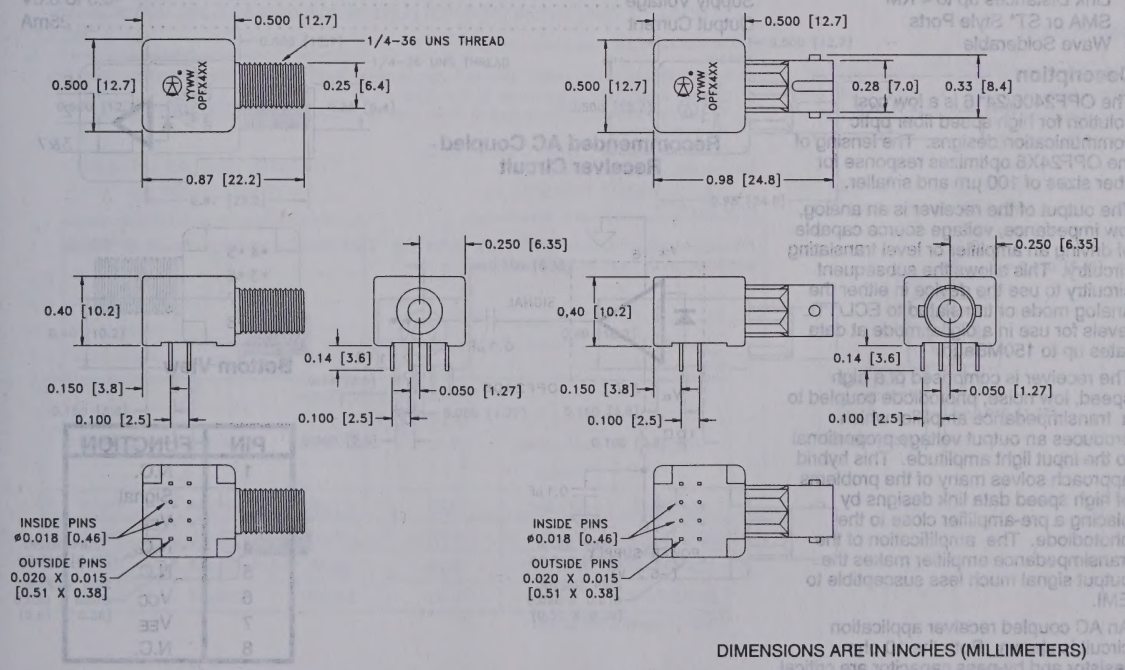
# Types OPF2404(SMA), OPF2414(ST*)

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

**4.75 ≤ $V_{CC}$ ≤ 5.25, $R_{LOAD}$ = 511 Ω, Fiber Sizes ≤ 100 Microns, N.A. ≤ 0.35**

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNIT | TEST CONDITION |
|---|---|---|---|---|---|---|
| $R_P$ | Responsivity | 5.1 | 7 | 10.9 | mV/µW | at 840 nm |
| | | 4.6 | | 12.3 | mV/µW | at 840 nm, -40°C ≤ $T_A$ ≤ +85°C |
| $V_{NO}$ | RMS Output Noise Voltage | | .30 | .36 | mV | $P_R$ = 0 µW |
| | | | | .43 | mV | $P_R$ = 0 µW, -40°C ≤ $T_A$ ≤ +85°C |
| $P_N$ | Equivalent Optical Noise Input Power | | -43.7 | -40.3 | dBm | |
| | | | .042 | .094 | µW | |
| $P_R$ | Peak Input Power | | | -12.6 | dBm | $T_A$ = 25°C |
| | | | | 55 | µW | $T_A$ = 25°C |
| | | | | -14 | dBm | -40°C ≤ $T_A$ ≤ +85°C |
| | | | | 40 | µW | -40°C ≤ $T_A$ ≤ +85°C |
| $I_{CC}$ | Power Supply Current | | 3.4 | 6.0 | mA | $R_{LOAD}$ = ∞ |
| $t_r$, $t_f$ | Rise Time, Fall Time (10% to 90%) | | 14 | 19.5 | ns | $P_R$ = 10 µW Peak, $R_{LOAD}$ = 511 Ω, $C_{LOAD}$ = 13 pF |
| PWD | Pulse Width Distortion | | | 2 | ns | $P_R$ = 40 µW Peak, $R_{LOAD}$ = 511 Ω, $C_{LOAD}$ = 13 pF |

## Mechanical Dimensions



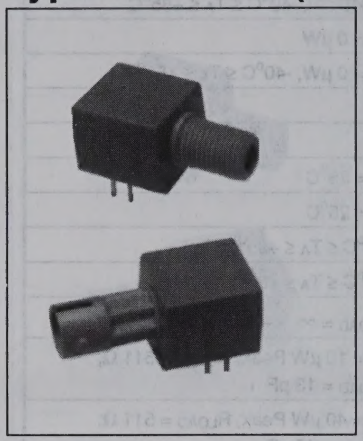

DIMENSIONS ARE IN INCHES (MILLIMETERS)

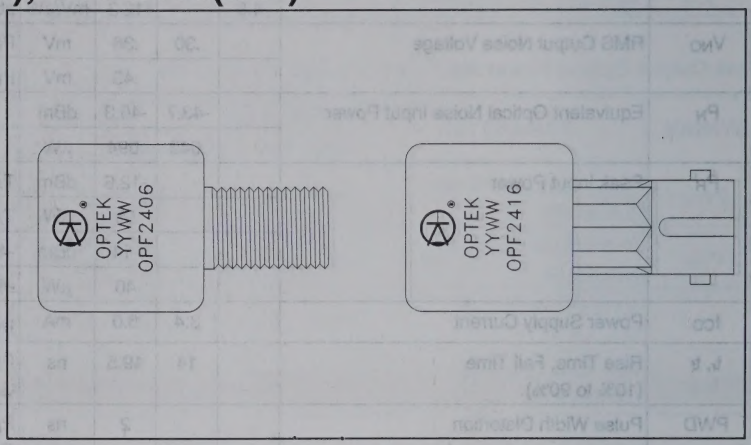
FIBER OPTIC COMPONENTS

PRELIMINARY

OPTEK

# 125 MHz Fiber Optic Receiver
## Types OPF2406(SMA), OPF2416(ST*)






### Features

- Low Cost
- Data Rates up to 150 MB
- No Mounting Hardware Required
- Wide Temperature Range
- Link Distances up to 4 KM
- SMA or ST* Style Ports
- Wave Solderable

### Description

The OPF2406/2416 is a low cost solution for high speed fiber optic communication designs. The lensing of the OPF24X6 optimizes response for fiber sizes of 100 µm and smaller.

The output of the receiver is an analog, low impedance, voltage source capable of driving an amplifier or level translating circuitry. This allows the subsequent circuitry to use the device in either the analog mode or translated to ECL/TTL levels for use in a digital mode at data rates up to 150MBaud.

The receiver is comprised of a high speed, low noise, photodiode coupled to a transimpedance amplifier which produces an output voltage proportional to the input light amplitude. This hybrid approach solves many of the problems of high speed data link designs by placing a pre-amplifier close to the photodiode. The amplification of the transimpedance amplifier makes the output signal much less susceptible to EMI.

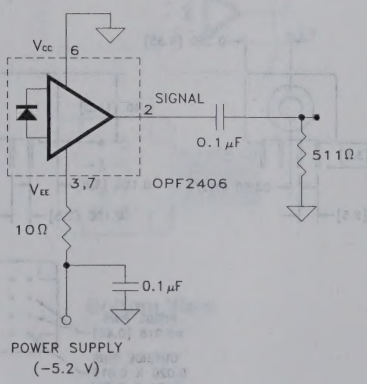
An AC coupled receiver application circuit is shown. Both the 10 ohm resistor and by-pass capacitor are critical.

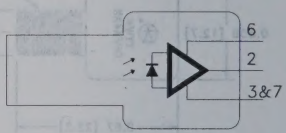
*ST is a registered trademark of AT&T.

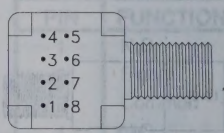
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature | -55°C to +85°C |
| Operating Temperature | -40°C to +85°C |
| Lead Soldering Temperature (for 10 sec.) | 260°C |
| Signal Pin Voltage | -0.5$V_{CC}$ |
| Supply Voltage | -0.5 to 6.0V |
| Output Current | 25mA |

### Recommended AC Coupled Receiver Circuit




Bottom View

| PIN | FUNCTION |
|---|---|
| 1 | N.C. |
| 2 | Signal |
| 3 | $V_{EE}$ |
| 4 | N.C. |
| 5 | N.C. |
| 6 | $V_{CC}$ |
| 7 | $V_{EE}$ |
| 8 | N.C. |

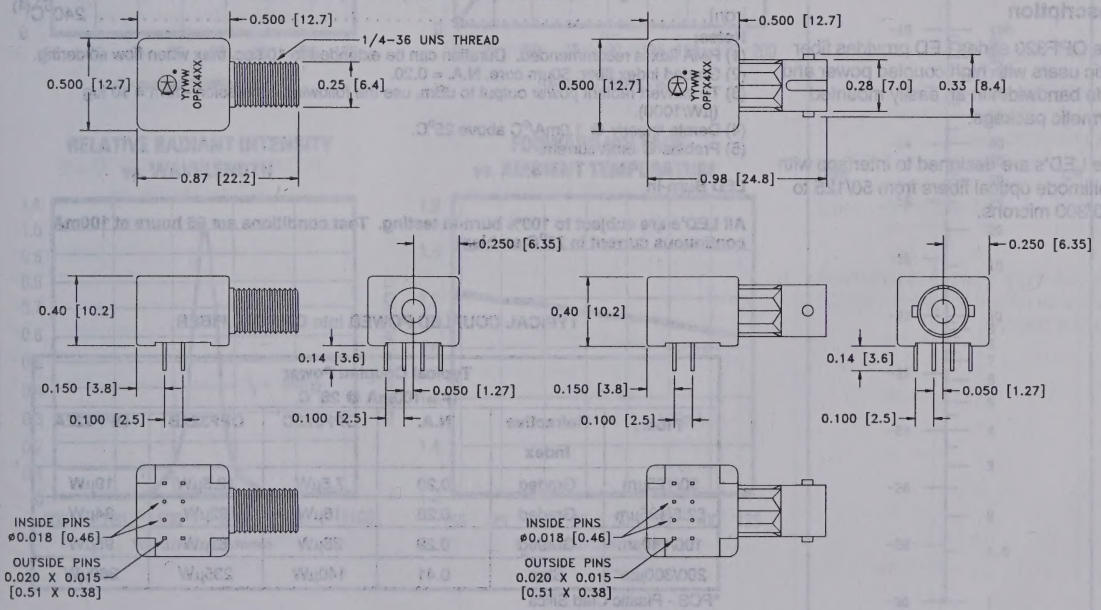
# Types OPF2406(SMA), OPF2416(ST*) PRELIMINARY

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

**-5.45 ≤ Supply Voltage ≤ -4.75, $R_{LOAD}$ = 511 Ω, Fiber Sizes ≤ 100 Microns, N.A. ≤ 0.35**

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNIT | TEST CONDITION |
|---|---|---|---|---|---|---|
| $R_P$ | Responsivity | 5 | 7 | 9 | mV/μW | at 840 nm, 50 MHz |
| | | 4.5 | | 11.5 | mV/μW | at 840 nm, 50 MHz -40°C ≤ $T_A$ ≤ +85°C |
| $V_{NO}$ | RMS Output Noise Voltage | | 0.38 | 0.53 | mV | Bandwidth Filtered @ 75 MHz, $P_R$ = 0 μW |
| | | | | 0.7 | mV | Unfiltered Bandwidth $P_R$ = 0 μW |
| $P_N$ | Equivalent Optical Noise Input Power (RMS) | | -43.0 | -41.9 | dBm | Bandwidth Filtered @ 75 MHz |
| | | | 0.050 | 0.065 | μW | |
| $P_R$ | Peak Input Power | | | -7.6 | dBm | $T_A$ = 25°C |
| | | | | 175 | μW | $T_A$ = 25°C |
| | | | | -8.2 | dBm | -40°C ≤ $T_A$ ≤ +85°C |
| | | | | 150 | μW | -40°C ≤ $T_A$ ≤ +85°C |
| $V_{odc}$ | DC Output Voltage | -4.2 | -3.1 | -2.4 | V | $P_R$ = 0 μW |
| $I_{EE}$ | Power Supply Current | | 9 | 15 | mA | $R_{LOAD}$ = ∞ |
| $t_r$, $t_f$ | Rise Time, Fall Time (10% to 90%) | | 3.3 | 6.3 | ns | $P_R$ = 100 μW, $R_{LOAD}$ = 511 Ω, $C_{LOAD}$ = 5 pF |
| PWD | Pulse Width Distortion | | 0.4 | 2.5 | ns | $P_R$ = 150 μW Peak, Pwidth = 10 ns, 50% Duty Cycle |

## Mechanical Dimensions



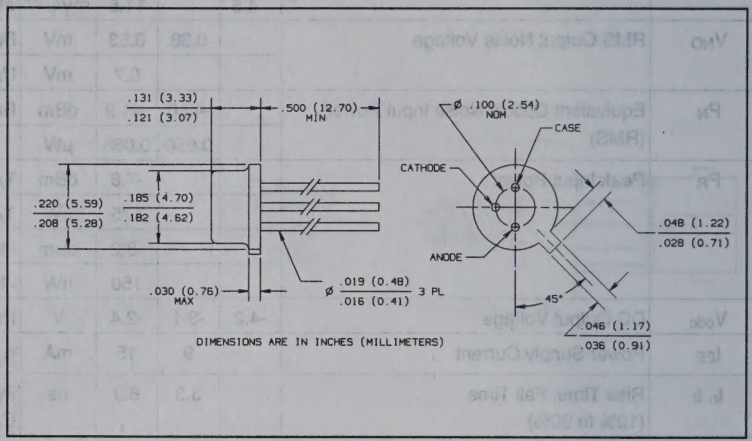

DIMENSIONS ARE IN INCHES (MILLIMETERS)

FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Fiber Optic GaAlAs LED
## Types OPF320A, OPF320B, OPF320C




### Features

- High radiant output for fiber optic applications
- High speed
- Electrically isolated from case

### Description

The OPF320 series LED provides fiber optic users with high coupled power and wide bandwidth in an easily mounted hermetic package.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 1.0V |
| Continuous Forward Current | 100mA(4) |
| Storage Temperature Range | -55°C to +150°C |
| Operating Temperature Range | -40°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-in**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Fiber | Refractive Index | N.A. | Typical Coupled Power IF = 100mA @ 25°C OPF322C | OPF322B | OPF322A |
|---|---|---|---|---|---|
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 19µW |
| 62.5/125µm | Graded | 0.28 | 16µW | 22µW | 34µW |
| 100/140µm | Graded | 0.29 | 38µW | 62µW | 95µW |
| 200/300µm* | Step | 0.41 | 140µW | 235µW | 360µW |

*PCS - Plastic Clad Silica

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

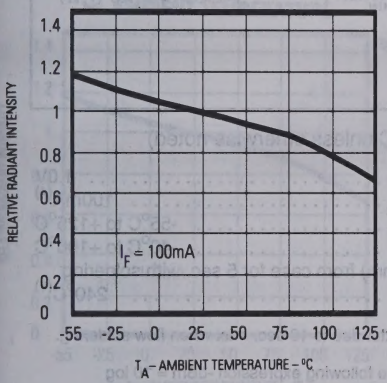
# Types OPF320A, OPF320B, OPF320C

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

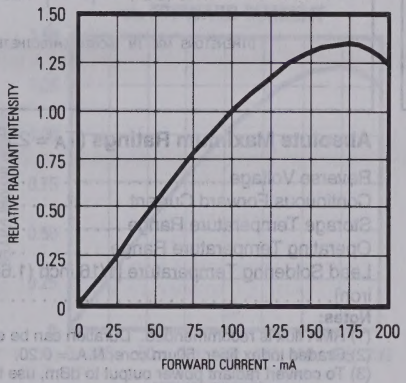
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF320C | 5.0 | 7.5 | | µW | $I_F$ = 100 mA(2) |
| | | OPF320B | 10.0 | 12.5 | | | |
| | | OPF320A | 15.0 | 19.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100 mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50 mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50 mA |
| $t_r$ | Output Rise Time | | | 6.0 | 8.0 | ns | $I_F$ = 100 mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | | 6.0 | 10.0 | ns | $I_F$ = 100 mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

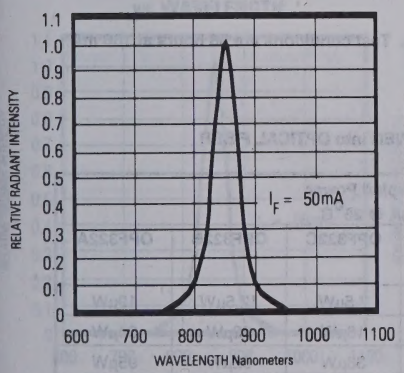
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



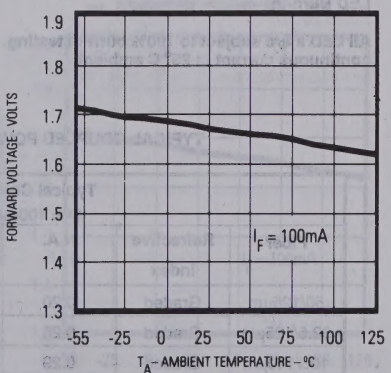

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

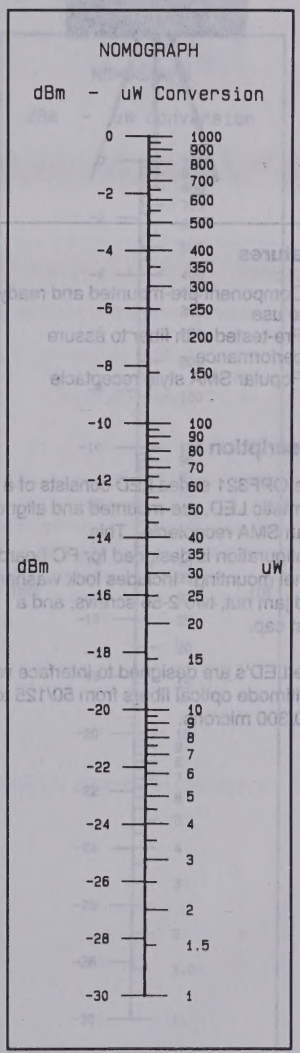



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



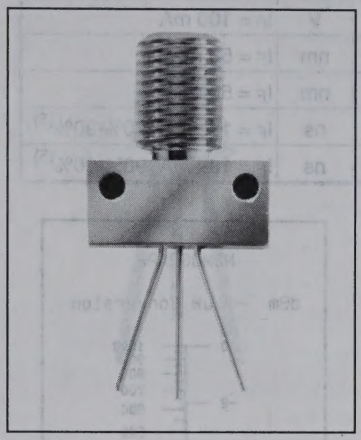

FIBER OPTIC COMPONENTS

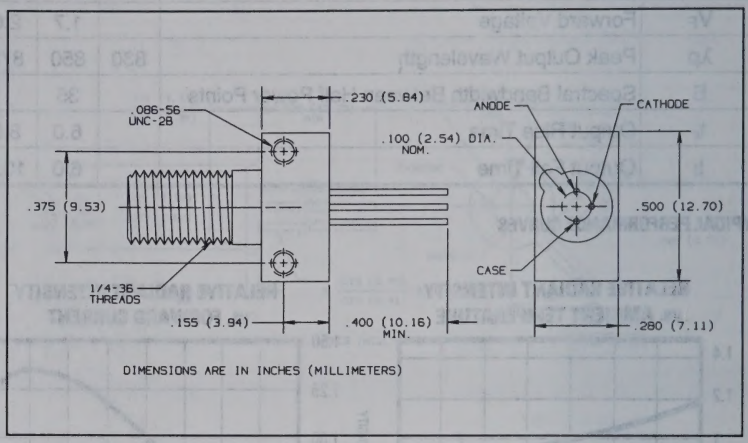
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# Fiber Optic GaAlAs LED in SMA Receptacle
## Types OPF321A, OPF321B, OPF321C






### Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle

### Description

The OPF321 series LED consists of a hermetic LED, pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +125°C
Operating Temperature Range ..... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Pre Bias @ 5mA current.

**LED Burn-in**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100 mA continuous current in 25° C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Fiber | Refractive Index | N.A. | Typical Coupled Power $I_F$ = 100mA @ 25°C OPF322C | OPF322B | OPF322A |
|---|---|---|---|---|---|
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 19µW |
| 62.5/125µm | Graded | 0.28 | 16µW | 22µW | 34µW |
| 100/140µm | Graded | 0.29 | 38µW | 62µW | 95µW |
| 200/300µm* | Step | 0.41 | 140µW | 235µW | 360µW |

*PCS - Plastic Clad Silica

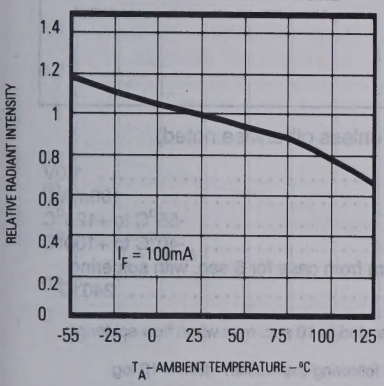
# Types OPF321A, OPF321B, OPF321C

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

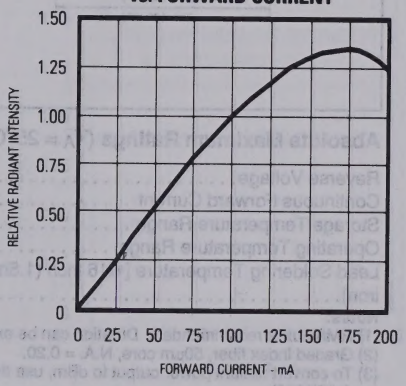
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF321C | 5.0 | 7.5 | | | |
| | | OPF321B | 10.0 | 12.5 | | µW | $I_F$ = 100 mA[2] |
| | | OPF321A | 15.0 | 19.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100 mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50 mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50 mA |
| $t_r$ | Output Rise Time | | | 6.0 | 8.0 | ns | $I_F$ = 100 mA, 10%-90%[5] |
| $t_f$ | Output Fall Time | | | 6.0 | 10.0 | ns | $I_F$ = 100 mA, 90%-10%[5] |

**TYPICAL PERFORMANCE CURVES**

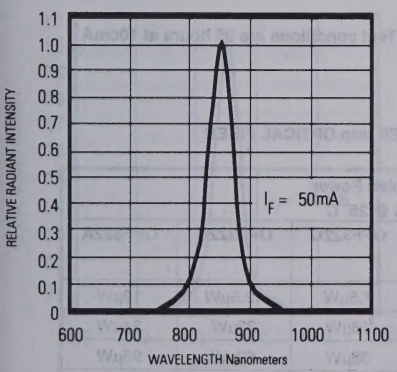
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



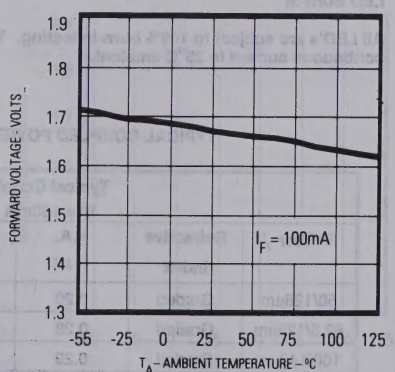

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

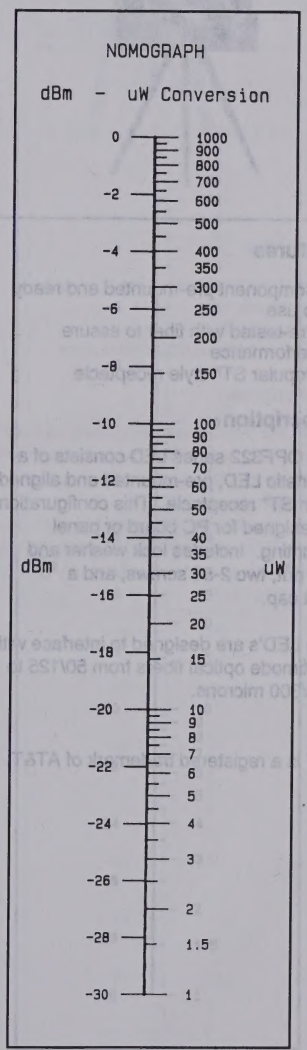



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



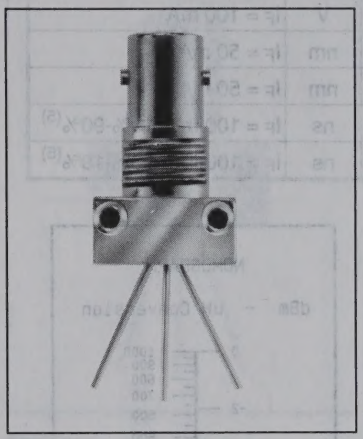



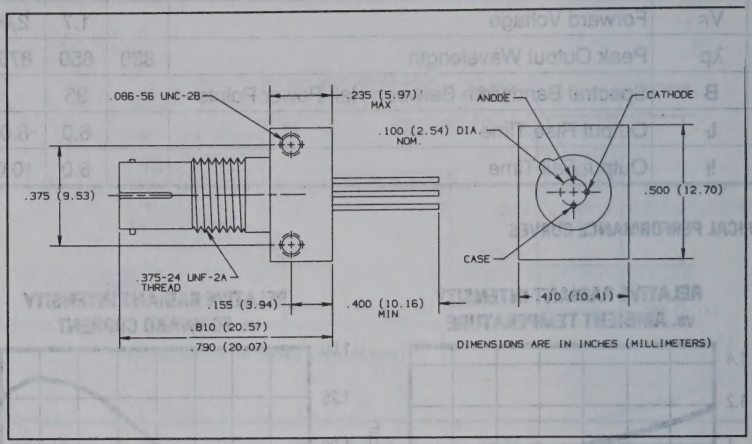

FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Fiber Optic GaAlAs LED in ST* Receptacle
## Types OPF322A, OPF322B, OPF322C






### Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle

### Description

The OPF322 series LED consists of a hermetic LED, pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

*ST is a registered trademark of AT&T.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 1.0V |
| Continuous Forward Current | 100mA(4) |
| Storage Temperature Range | -55°C to +125°C |
| Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current

**LED Burn-in**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Typical Coupled Power $I_F$ = 100mA @ 25°C | | | | | |
|---|---|---|---|---|---|
| Fiber | Refractive Index | N.A. | OPF322C | OPF322B | OPF322A |
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 19µW |
| 62.5/125µm | Graded | 0.28 | 16µW | 22µW | 34µW |
| 100/140µm | Graded | 0.29 | 38µW | 62µW | 95µW |
| 200/300µm* | Step | 0.41 | 140µW | 235µW | 360µW |

*PCS - Plastic Clad Silica

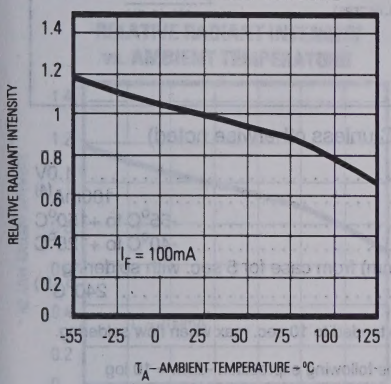
# Types OPF322A, OPF322B, OPF322C

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

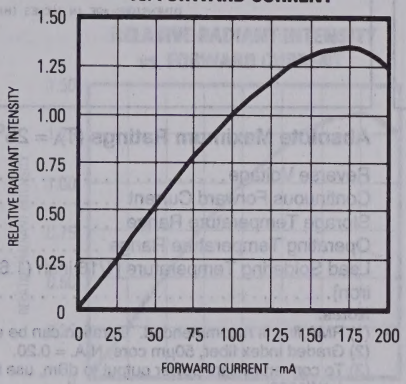
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF322C | 5.0 | 7.5 | | | |
| | | OPF322B | 10.0 | 12.5 | | µW | $I_F$ = 100 mA[2] |
| | | OPF322A | 15.0 | 19.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100 mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50 mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50 mA |
| $t_r$ | Output Rise Time | | | 6.0 | 8.0 | ns | $I_F$ = 100 mA, 10%-90%[5] |
| $t_f$ | Output Fall Time | | | 6.0 | 10.0 | ns | $I_F$ = 100 mA, 90%-10%[5] |

**TYPICAL PERFORMANCE CURVES**

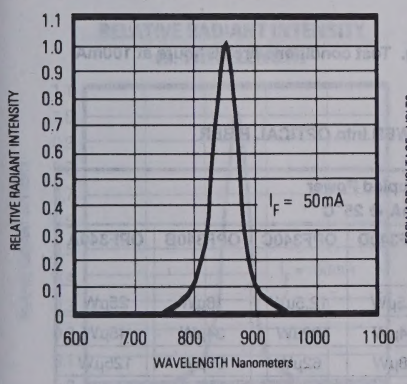
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



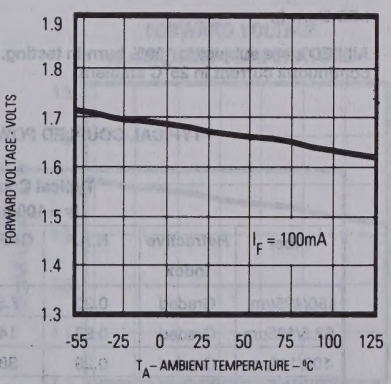

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

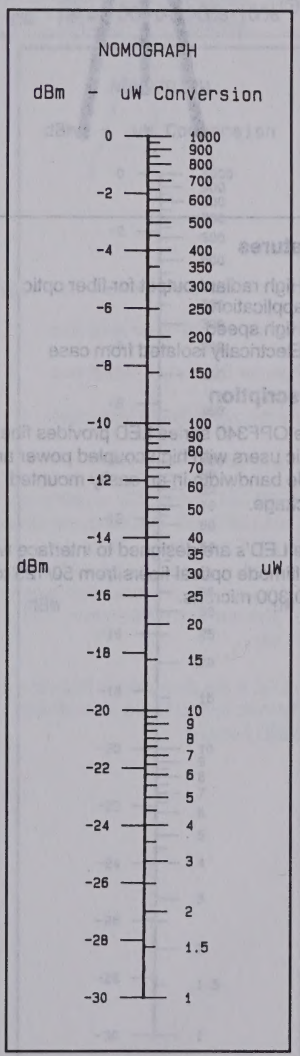



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**



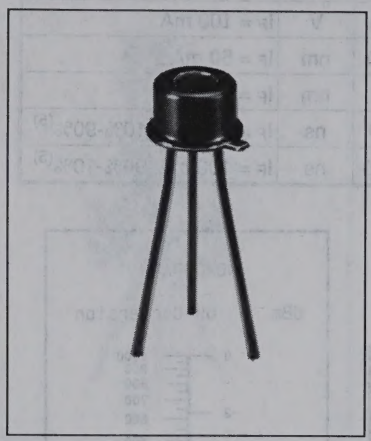

**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**

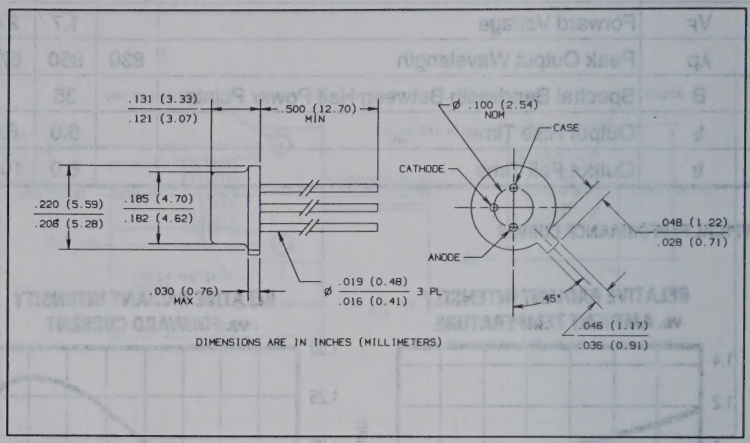



FIBER OPTIC COMPONENTS

# Fiber Optic GaAlAs High Speed LED
## Types OPF340A, OPF340B, OPF340C, OPF340D






### Features

- High radiant output for fiber optic applications
- High speed
- Electrically isolated from case

### Description

The OPF340 series LED provides fiber optic users with high coupled power and wide bandwidth in an easily mounted package.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 1.0V |
| Continuous Forward Current | 100mA(4) |
| Storage Temperature Range | -55°C to +150°C |
| Operating Temperature Range | -40°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-in**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Typical Coupled Power $I_F$ = 100mA @ 25°C | | | | | | |
|---|---|---|---|---|---|---|
| Fiber | Refractive Index | N.A. | OPF340D | OPF340C | OPF340B | OPF340A |
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 18µW | 25µW |
| 62.5/125µm | Graded | 0.28 | 14µW | 22µW | 34µW | 45µW |
| 100/140µm | Graded | 0.29 | 38µW | 62µW | 95µW | 125µW |
| 200/300µm* | Step | 0.41 | 140µW | 235µW | 340µW | 475µW |

*PCS - Plastic Clad Silica

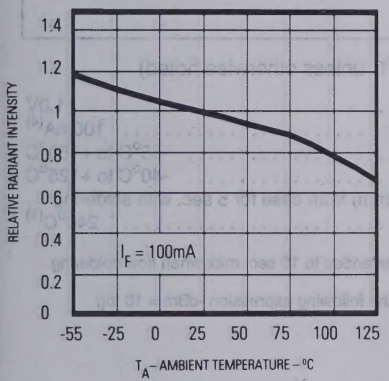
# Types OPF340A, OPF340B, OPF340C, OPF340D

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

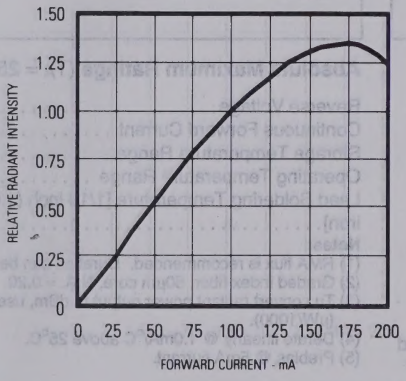
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF340D | 5.0 | 7.5 | | | |
| | | OPF340C | 10.0 | 12.5 | | | |
| | | OPF340B | 15.0 | 18.0 | | µW | $I_F$ = 100mA(2) |
| | | OPF340A | 20.0 | 25.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 4.5 | 6.0 | ns | $I_F$ = 100mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | | 4.5 | 6.0 | ns | $I_F$ = 100mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

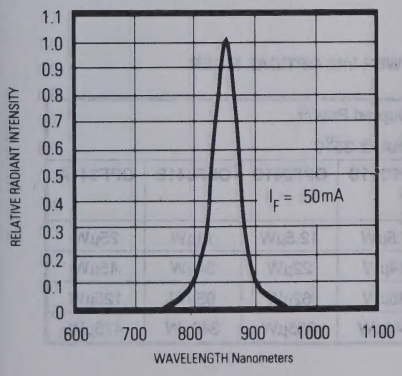
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



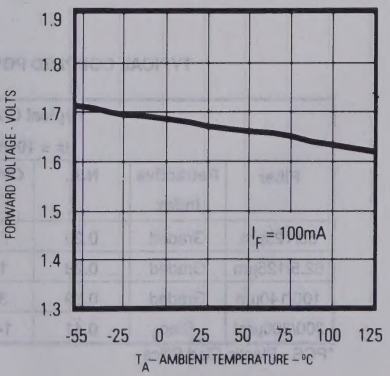

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

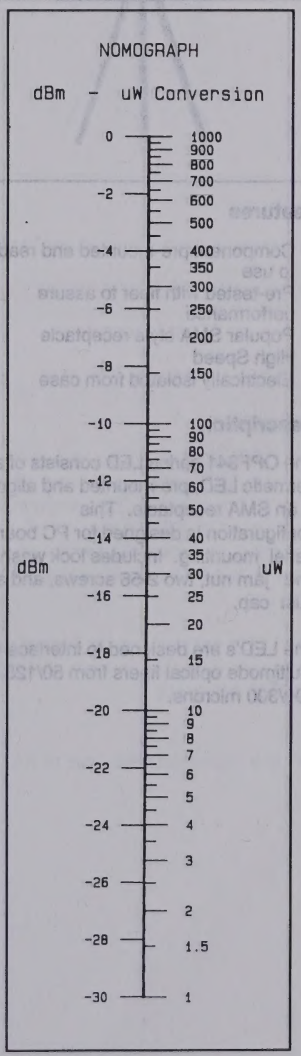



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



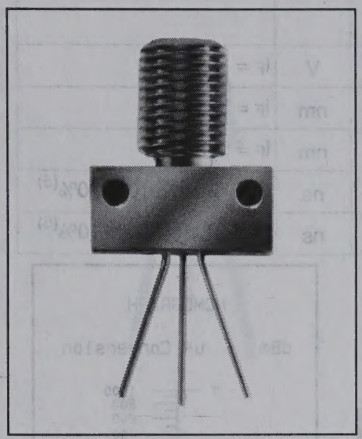



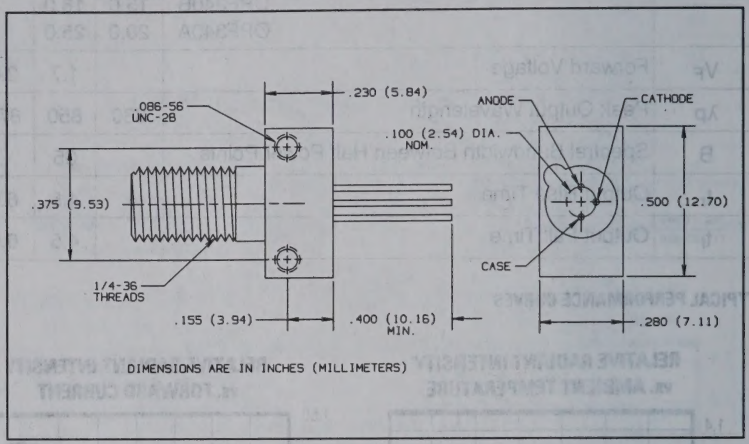

FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Fiber Optic GaAlAs High Speed LED in SMA Receptacle
# Types OPF341A, OPF341B, OPF341C, OPF341D






## Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- High Speed
- Electrically isolated from case

## Description

The OPF341 series LED consists of a hermetic LED, pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 1.0V |
| Continuous Forward Current | 100mA(4) |
| Storage Temperature Range | -55°C to +150°C |
| Operating Temperature Range | -40°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-in**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Fiber | Refractive Index | N.A. | Typical Coupled Power $I_F$ = 100mA @ 25°C OPF341D | OPF341C | OPF341B | OPF341A |
|---|---|---|---|---|---|---|
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 18µW | 25µW |
| 62.5/125µm | Graded | 0.28 | 14µW | 22µW | 34µW | 45µW |
| 100/140µm | Graded | 0.29 | 38µW | 62µW | 95µW | 125µW |
| 200/300µm* | Step | 0.41 | 140µW | 235µW | 340µW | 475µW |

*PCS - Plastic Clad Silica

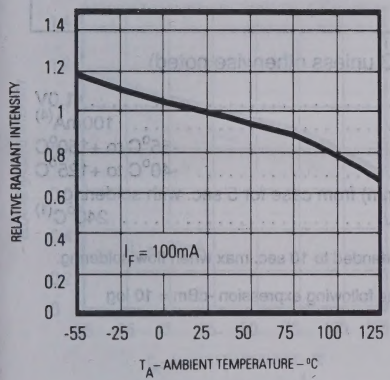
# Types OPF341A, OPF341B, OPF341C, OPF341D

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

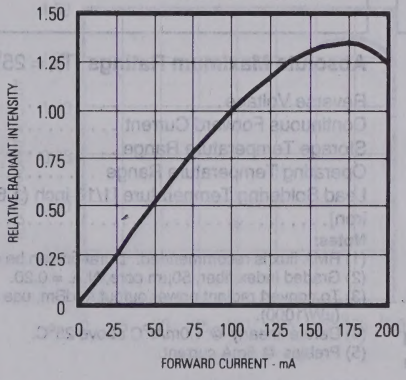
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF341D | 5.0 | 7.5 | | | |
| | | OPF341C | 10.0 | 12.5 | | | |
| | | OPF341B | 15.0 | 18.0 | | µW | $I_F$ = 100mA(2) |
| | | OPF341A | 20.0 | 25.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 4.5 | 6.0 | ns | $I_F$ = 100mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | | 4.5 | 6.0 | ns | $I_F$ = 100mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

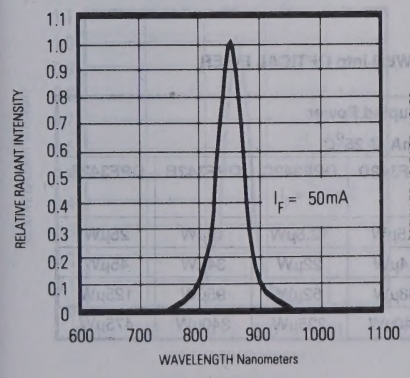
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



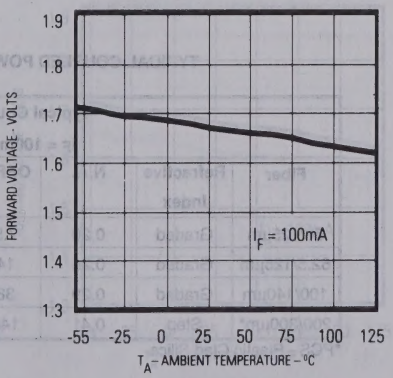

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

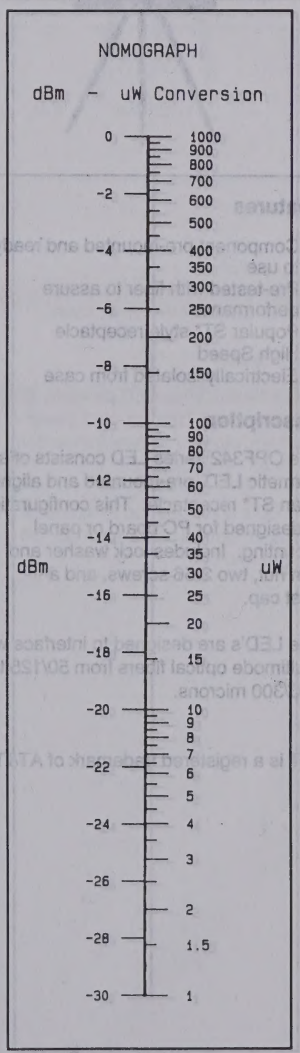



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



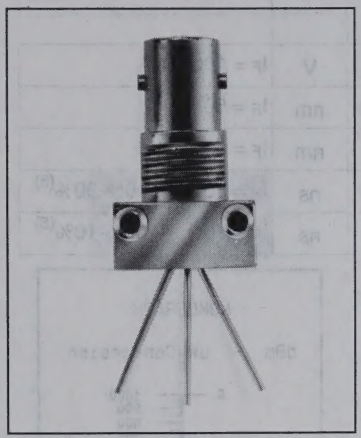



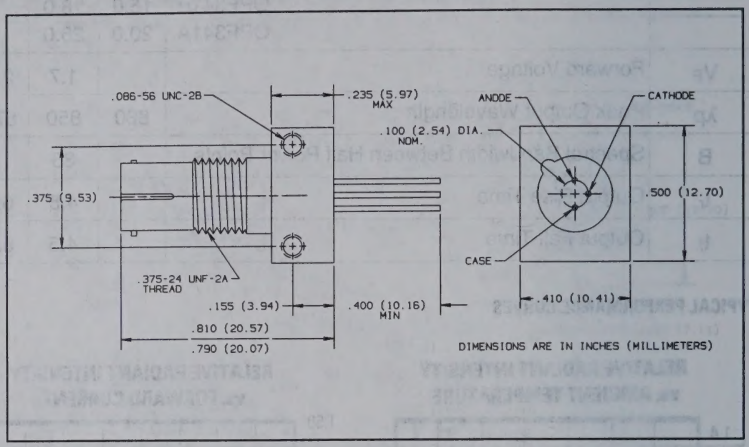

FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Fiber Optic GaAlAs High Speed LED in ST* Receptacle
## Types OPF342A, OPF342B, OPF342C, OPF342D






### Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle
- High Speed
- Electrically isolated from case

### Description

The OPF342 series LED consists of a hermetic LED, pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

*ST is a registered trademark of AT&T.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +150°C
Operating Temperature Range ..... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-in**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Typical Coupled Power $I_F$ = 100mA @ 25°C | | | | | | |
|---|---|---|---|---|---|---|
| Fiber | Refractive Index | N.A. | OPF342D | OPF342C | OPF342B | OPF342A |
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 18µW | 25µW |
| 62.5/125µm | Graded | 0.28 | 14µW | 22µW | 34µW | 45µW |
| 100/140µm | Graded | 0.29 | 38µW | 62µW | 95µW | 125µW |
| 200/300µm* | Step | 0.41 | 140µW | 235µW | 340µW | 475µW |

*PCS - Plastic Clad Silica

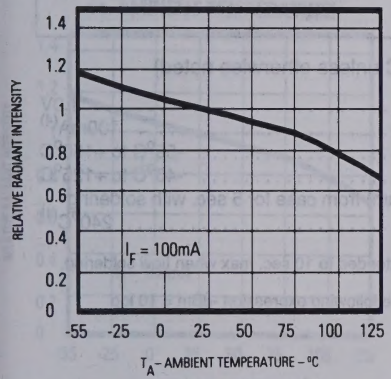
# Types OPF342A, OPF342B, OPF342C, OPF342D

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

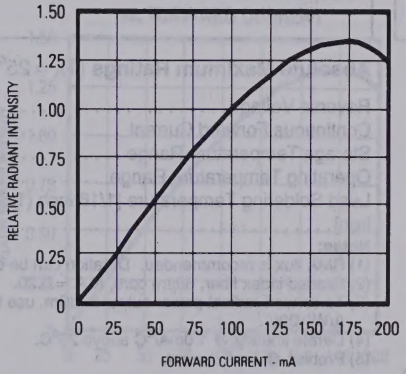
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF342D | 5.0 | 7.5 | | µW | $I_F$ = 100mA[2] |
| | | OPF342C | 10.0 | 12.5 | | | |
| | | OPF342B | 15.0 | 18.0 | | | |
| | | OPF342A | 20.0 | 25.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 3.5 | 4.5 | ns | $I_F$ = 100mA, 10%-90%[5] |
| $t_f$ | Output Fall Time | | | 3.5 | 4.5 | ns | $I_F$ = 100mA, 90%-10%[5] |

**TYPICAL PERFORMANCE CURVES**

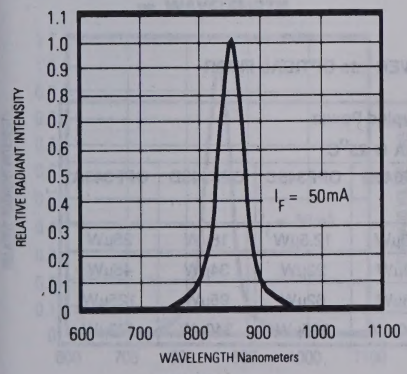
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



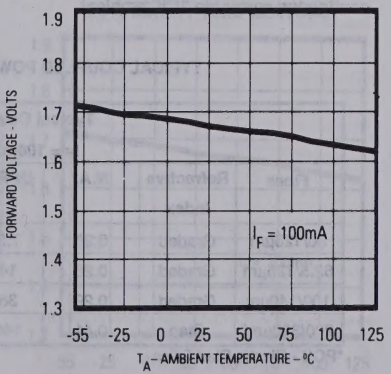

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

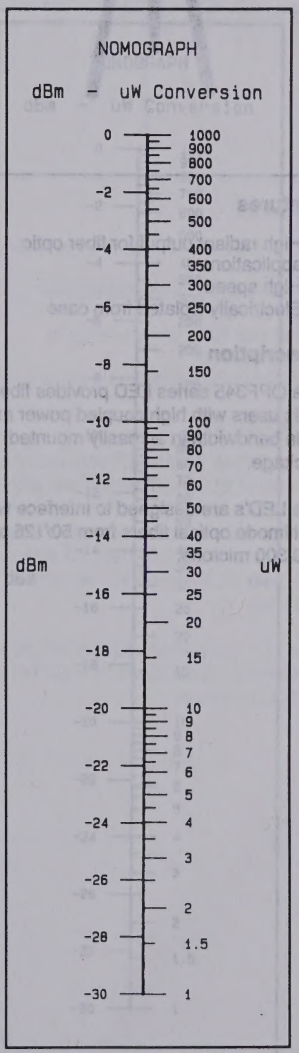



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



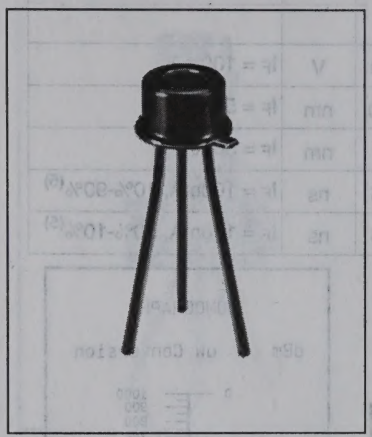



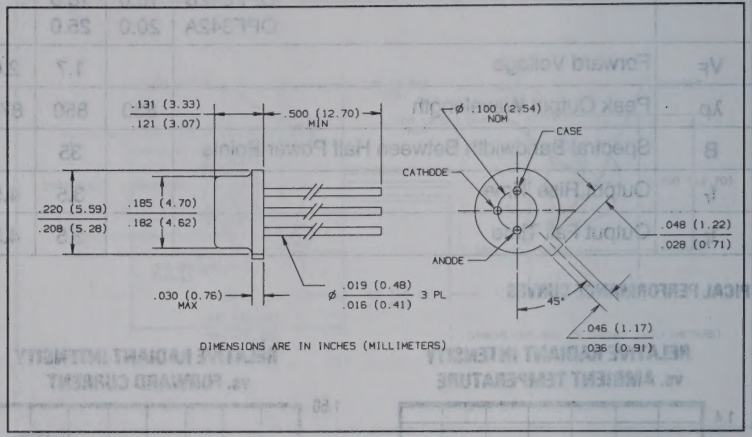

FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

# Fiber Optic GaAlAs High Speed LED
## Types OPF345A, OPF345B, OPF345C, OPF345D






### Features

- High radiant output for fiber optic applications
- High speed
- Electrically isolated from case

### Description

The OPF345 series LED provides fiber optic users with high coupled power and wide bandwidth in an easily mounted package.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +150°C
Operating Temperature Range ..... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-in**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| | | Typical Coupled Power $I_F$ = 100mA @ 25°C | | | | |
|---|---|---|---|---|---|---|
| Fiber | Refractive Index | N.A. | OPF345D | OPF345C | OPF345B | OPF345A |
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 18µW | 25µW |
| 62.5/125µm | Graded | 0.28 | 14µW | 22µW | 34µW | 45µW |
| 100/140µm | Graded | 0.29 | 38µW | 62µW | 95µW | 125µW |
| 200/300µm* | Step | 0.41 | 140µW | 235µW | 340µW | 475µW |

*PCS - Plastic Clad Silica

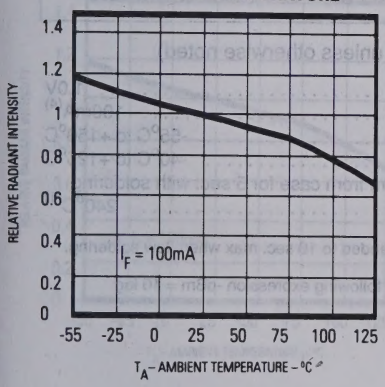
# Types OPF345A, OPF345B, OPF345C, OPF345D

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

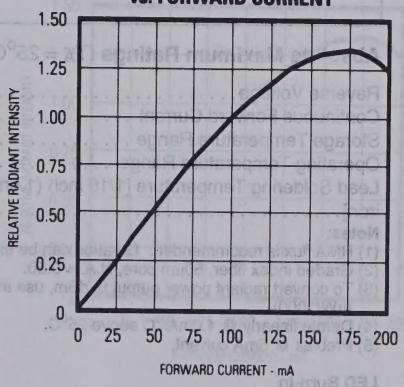
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF345D | 5.0 | 7.5 | | | |
| | | OPF345C | 10.0 | 12.5 | | | |
| | | OPF345B | 15.0 | 18.0 | | µW | $I_F$ = 100mA(2) |
| | | OPF345A | 20.0 | 25.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 3.5 | 4.5 | ns | $I_F$ = 100mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | | 3.5 | 4.5 | ns | $I_F$ = 100mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

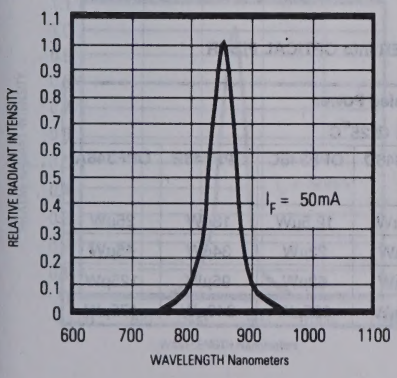
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



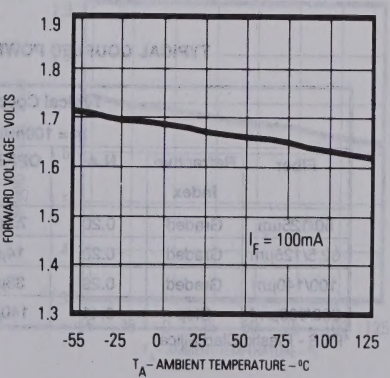

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

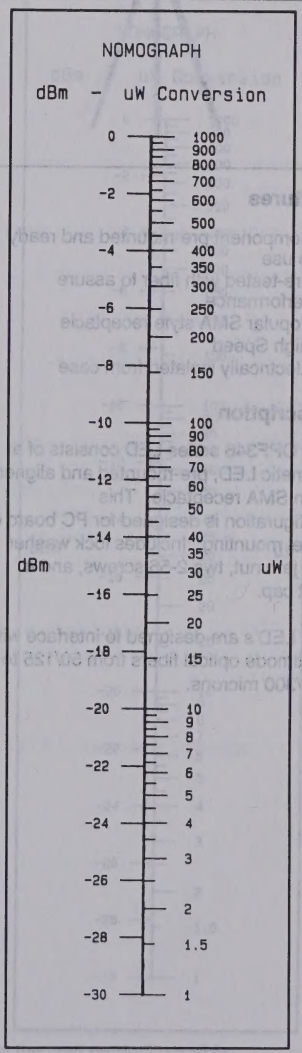



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**

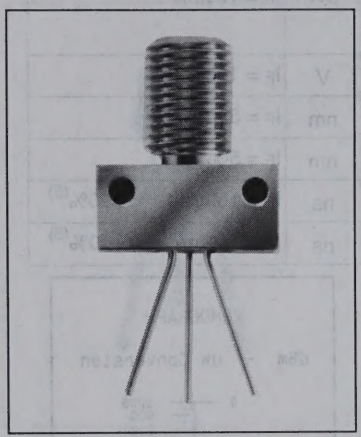


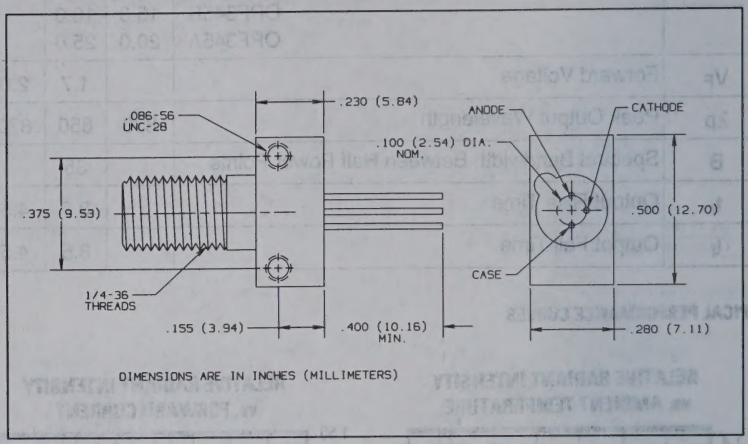




FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Fiber Optic GaAlAs High Speed LED in SMA Receptacle
# Types OPF346A, OPF346B, OPF346C, OPF346D






## Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- High Speed
- Electrically isolated from case

## Description

The OPF346 series LED consists of a hermetic LED, pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +150°C
Operating Temperature Range ..... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-in**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Typical Coupled Power $I_F$ = 100mA @ 25°C | | | | | | |
|---|---|---|---|---|---|---|
| **Fiber** | **Refractive Index** | **N.A.** | **OPF346D** | **OPF346C** | **OPF346B** | **OPF346A** |
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 18µW | 25µW |
| 62.5/125µm | Graded | 0.28 | 14µW | 22µW | 34µW | 45µW |
| 100/140µm | Graded | 0.29 | 38µW | 62µW | 95µW | 125µW |
| 200/300µm* | Step | 0.41 | 140µW | 235µW | 340µW | 475µW |

*PCS - Plastic Clad Silica

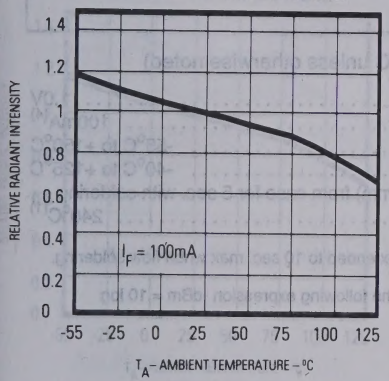
# Types OPF346A, OPF346B, OPF346C, OPF346D

Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

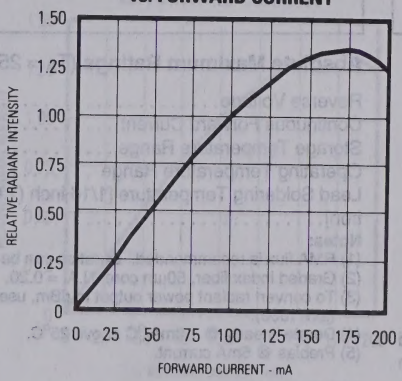
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF346D | 5.0 | 7.5 | | | |
| | | OPF346C | 10.0 | 12.5 | | | |
| | | OPF346B | 15.0 | 18.0 | | µW | $I_F$ = 100mA(2) |
| | | OPF346A | 20.0 | 25.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 3.5 | 4.5 | ns | $I_F$ = 100mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | | 3.5 | 4.5 | ns | $I_F$ = 100mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

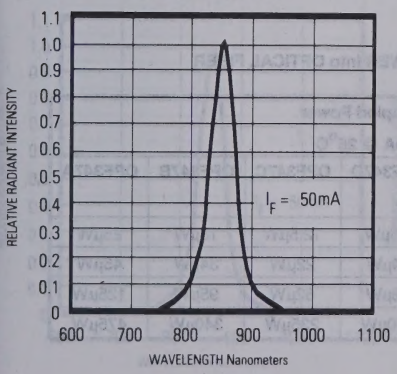
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



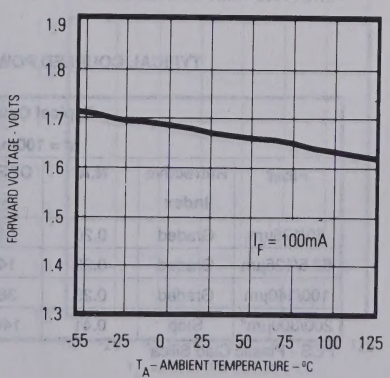

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

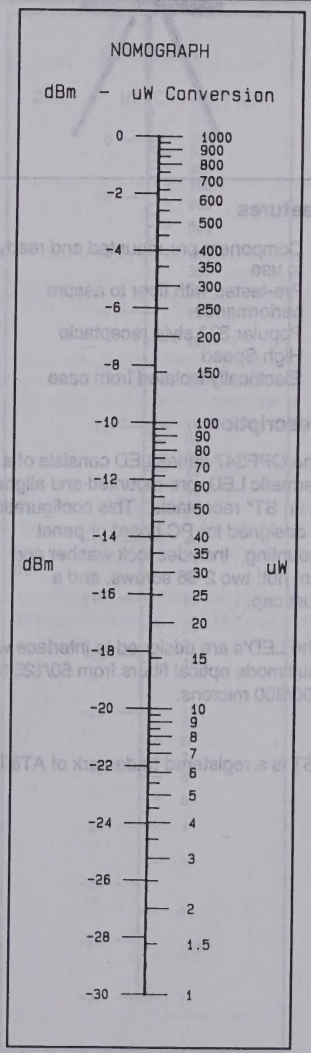



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**

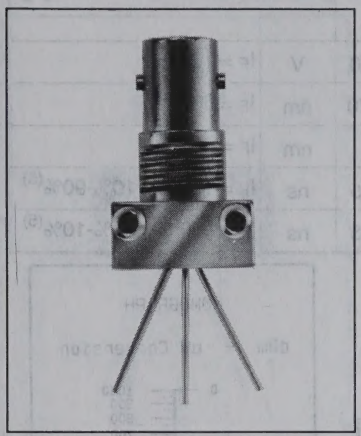


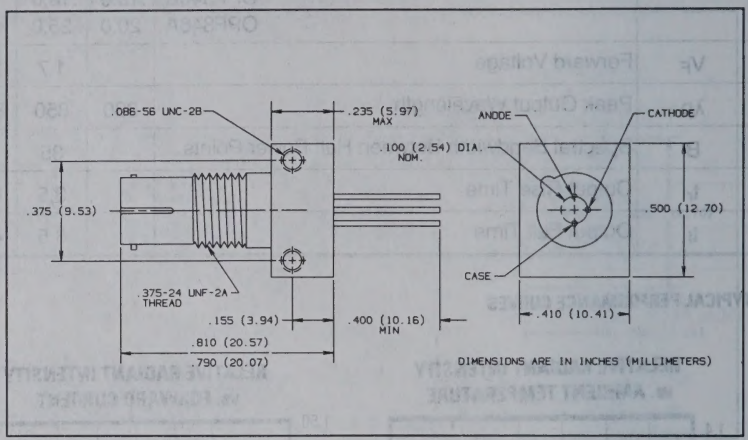




FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Fiber Optic GaAlAs High Speed LED in ST* Receptacle
## Types OPF347A, OPF347B, OPF347C, OPF347D






### Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle
- High Speed
- Electrically isolated from case

### Description

The OPF347 series LED consists of a hermetic LED, pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

*ST is a registered trademark of AT&T.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +150°C
Operating Temperature Range ..... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-in**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Fiber | Refractive Index | N.A. | Typical Coupled Power $I_F$ = 100mA @ 25°C OPF347D | OPF347C | OPF347B | OPF347A |
|---|---|---|---|---|---|---|
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 18µW | 25µW |
| 62.5/125µm | Graded | 0.28 | 14µW | 22µW | 34µW | 45µW |
| 100/140µm | Graded | 0.29 | 38µW | 62µW | 95µW | 125µW |
| 200/300µm* | Step | 0.41 | 140µW | 235µW | 340µW | 475µW |

*PCS - Plastic Clad Silica

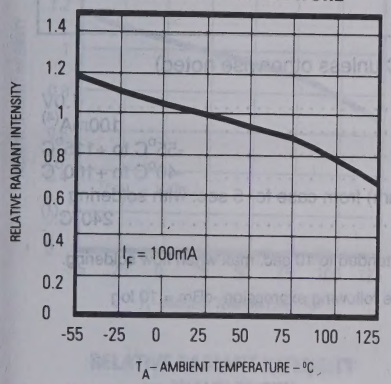
# Types OPF347A, OPF347B, OPF347C, OPF347D

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

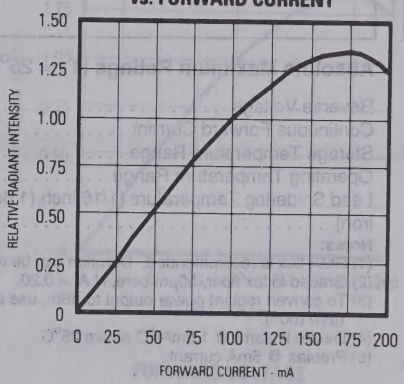
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF347D | 5.0 | 7.5 | | | |
| | | OPF347C | 10.0 | 12.5 | | | |
| | | OPF347B | 15.0 | 18.0 | | µW | $I_F$ = 100mA(2) |
| | | OPF347A | 20.0 | 25.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 3.5 | 4.5 | ns | $I_F$ = 100mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | | 3.5 | 4.5 | ns | $I_F$ = 100mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

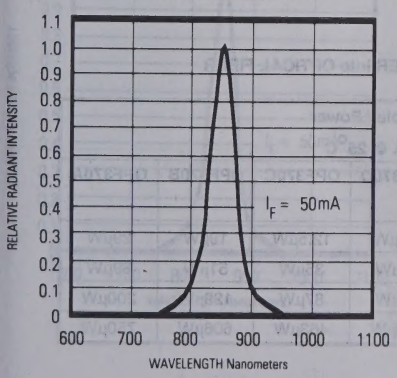
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



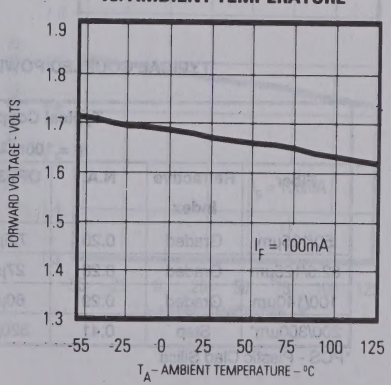

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

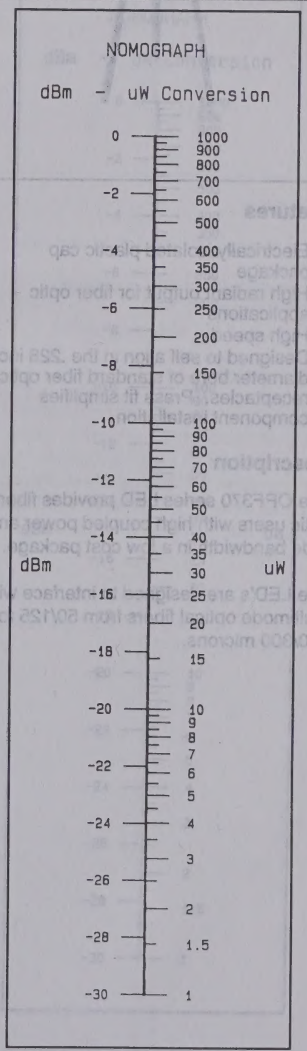



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**

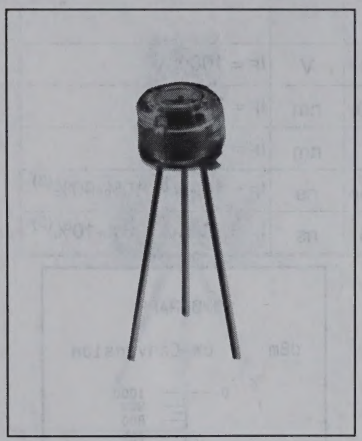


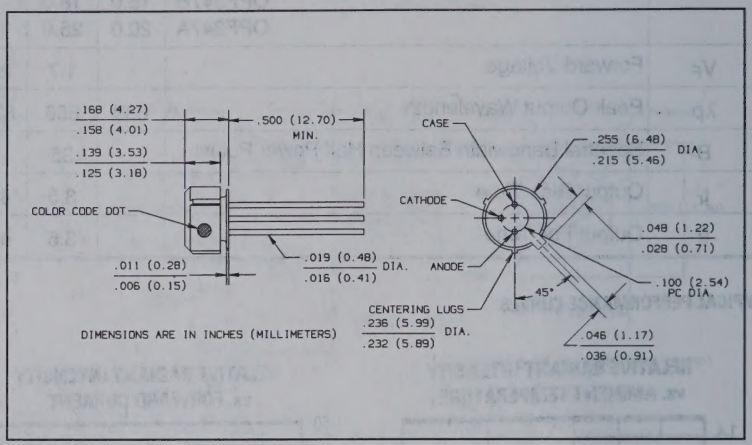




FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Fiber Optic GaAlAs LED
## Types OPF370A, OPF370B, OPF370C, OPF370D






### Features

- Electrically isolated plastic cap package
- High radiant output for fiber optic applications
- High speed
- Designed to self align in the .228 inch diameter bore of standard fiber optic receptacles. Press fit simplifies component installation.

### Description

The OPF370 series LED provides fiber optic users with high coupled power and wide bandwidth in a low cost package.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +115°C
Operating Temperature Range ..... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-in**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25 °C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Typical Coupled Power $I_F$ = 100mA @ 25°C | | | | | | |
|---|---|---|---|---|---|---|
| Fiber | Refractive Index | N.A. | OPF370D | OPF370C | OPF370B | OPF370A |
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 19µW | 29µW |
| 62.5/125µm | Graded | 0.28 | 27µW | 35µW | 51µW | 89µW |
| 100/140µm | Graded | 0.29 | 60µW | 87µW | 129µW | 200µW |
| 200/300µm* | Step | 0.41 | 320µW | 463µW | 606µW | 750µW |

*PCS - Plastic Clad Silica

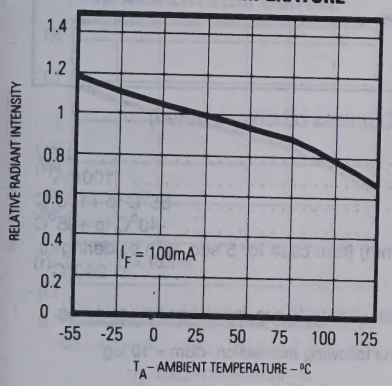
# Types OPF370A, OPF370B, OPF370C, OPF370D

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

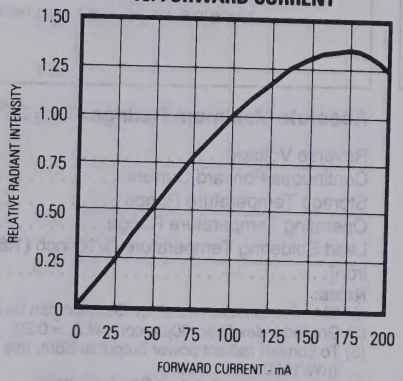
| Symbol | Parameter | Dot | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF370D (No Dot) | 5.0 | 7.5 | | | |
| | | OPF370C (Blue) | 10.0 | 12.5 | | | |
| | | OPF370B (Yellow) | 15.0 | 19.0 | | µW | $I_F$ = 100mA(2) |
| | | OPF370A (Red) | 25.0 | 29.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Band Width Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 6.0 | 8.0 | ns | $I_F$ = 100mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | | 6.0 | 10.0 | ns | $I_F$ = 100mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

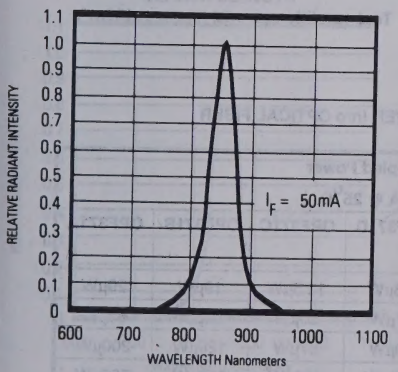
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



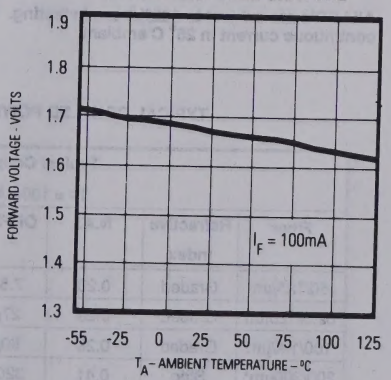

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

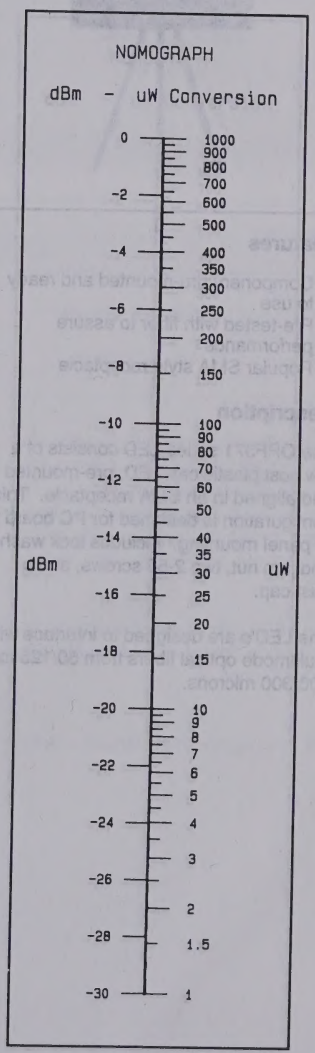



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**



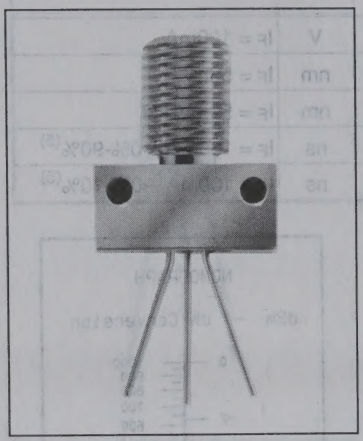

**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**

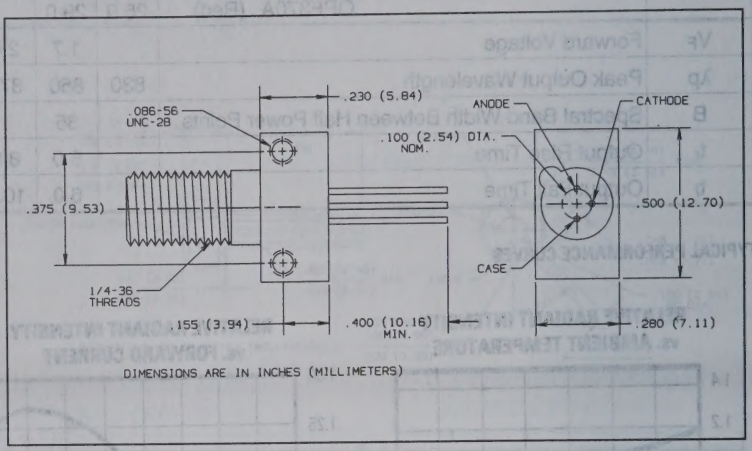



FIBER OPTIC COMPONENTS

# Fiber Optic GaAlAs LED in SMA Receptacle
# Types OPF371A, OPF371B, OPF371C, OPF371D






## Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle

## Description

The OPF371 series LED consists of a low cost plastic cap LED, pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with mulitmode optical fibers from 50/125 to 200/300 microns.

## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +100°C
Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Pre Bias @ 5mA current and terminated into 50 Ω load.

**LED Burn-in**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25° C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Fiber | Refractive Index | N.A. | Typical Coupled Power IF = 100mA @ 25°C OPF371D | OPF371C | OPF371B | OPF371A |
|---|---|---|---|---|---|---|
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 19µW | 29µW |
| 62.5/125µm | Graded | 0.28 | 27µW | 35µW | 51µW | 89µW |
| 100/140µm | Graded | 0.29 | 60µW | 87µW | 129µW | 200µW |
| 200/300µm* | Step | 0.41 | 320µW | 463µW | 606µW | 750µW |

*PCS - Plastic Clad Silica

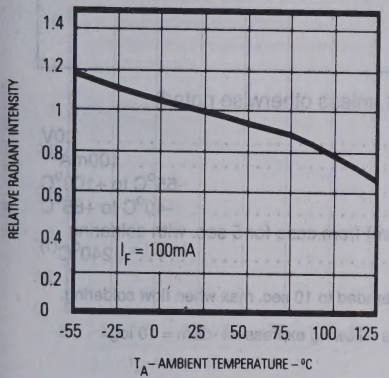
# Types OPF371A, OPF371B, OPF371C, OPF371D

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

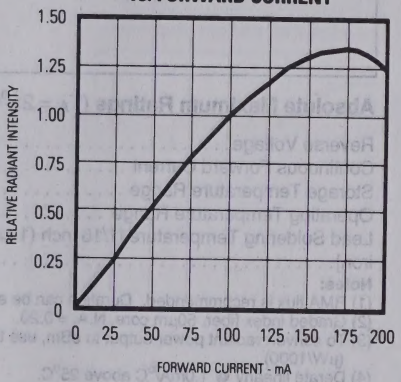
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF371D | 5.0 | 7.5 | | | |
| | | OPF371C | 10.0 | 12.5 | | | |
| | | OPF371B | 15.0 | 19.0 | | µW | $I_F$ = 100mA(2) |
| | | OPF371A | 25.0 | 29.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Band Width Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 6.0 | 8.0 | ns | $I_F$ = 100mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | | 6.0 | 10.0 | ns | $I_F$ = 100mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

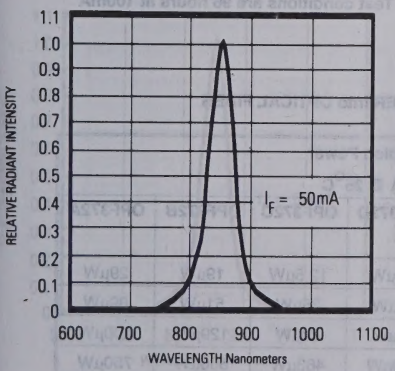
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



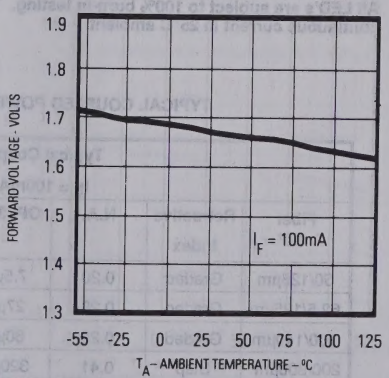

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

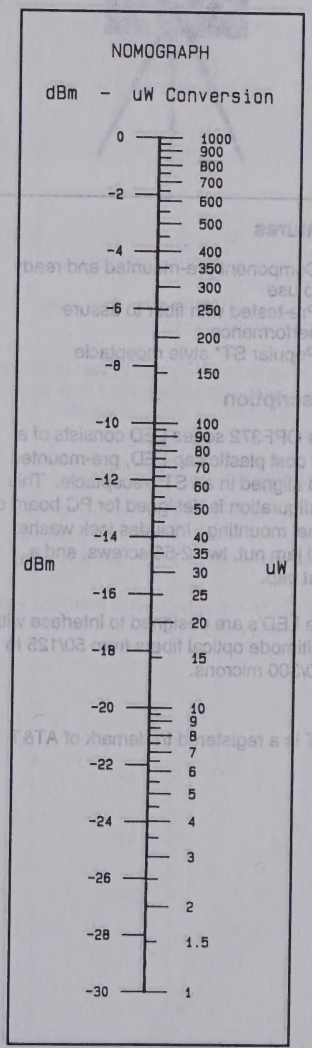



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**

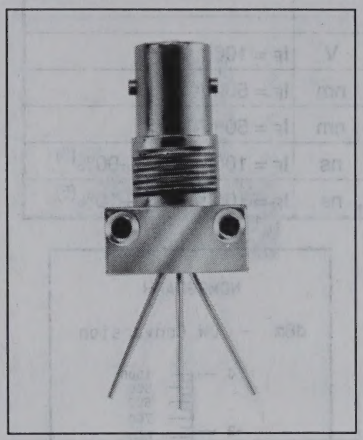


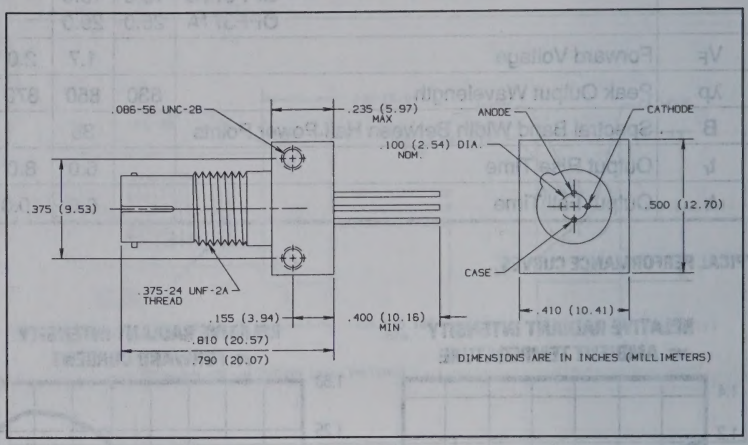




FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Fiber Optic GaAlAs LED in ST* Receptacle
# Types OPF372A, OPF372B, OPF372C, OPF372D






## Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle

## Description

The OPF372 series LED consists of a low cost plastic cap LED, pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

*ST is a registered trademark of AT&T.

## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +100°C
Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-in**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Fiber | Refractive Index | N.A. | Typical Coupled Power IF = 100mA @ 25°C OPF372D | OPF372C | OPF372B | OPF372A |
|---|---|---|---|---|---|---|
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 19µW | 29µW |
| 62.5/125µm | Graded | 0.28 | 27µW | 35µW | 51µW | 89µW |
| 100/140µm | Graded | 0.29 | 60µW | 87µW | 129µW | 200µW |
| 200/300µm* | Step | 0.41 | 320µW | 463µW | 606µW | 750µW |

*PCS - Plastic Clad Silica

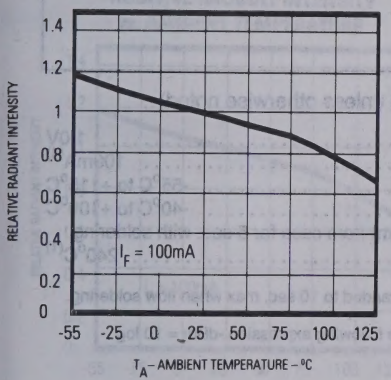
# Types OPF372A, OPF372B, OPF372C, OPF372D

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

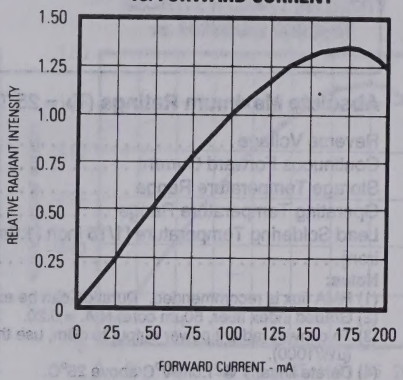
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF372D | 5.0 | 7.5 | | | |
| | | OPF372C | 10.0 | 12.5 | | | |
| | | OPF372B | 15.0 | 19.0 | | µW | $I_F$ = 100mA(2) |
| | | OPF372A | 25.0 | 29.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Band Width Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 6.0 | 8.0 | ns | $I_F$ = 100mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | | 6.0 | 10.0 | ns | $I_F$ = 100mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

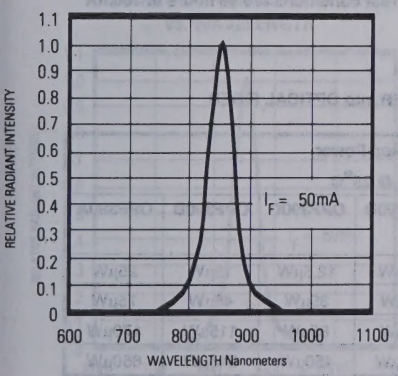
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



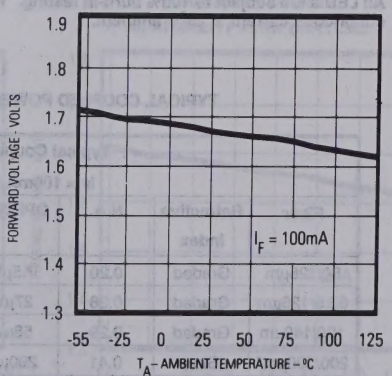

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

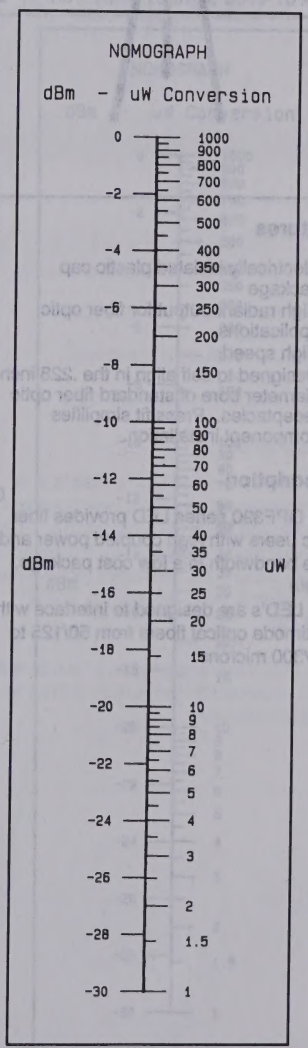



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



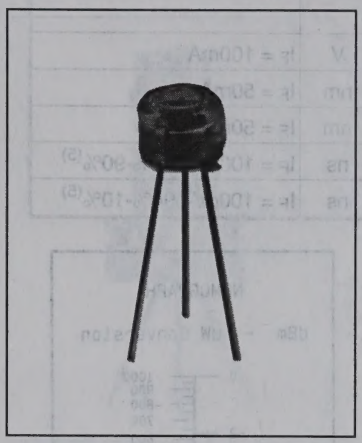



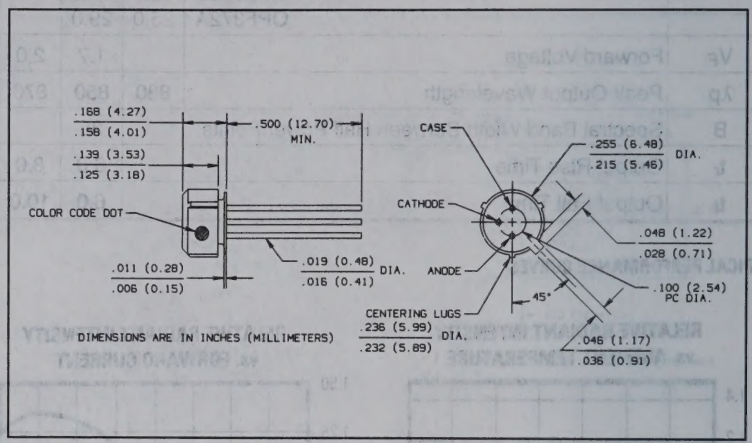

FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Fiber Optic GaAlAs High Speed LED
## Types OPF390A, OPF390B, OPF390C, OPF390D






### Features

- Electrically isolated plastic cap package
- High radiant output for fiber optic applications
- High speed
- Designed to self align in the .228 inch diameter bore of standard fiber optic receptacles. Press fit simplifies component installation.

### Description

The OPF390 series LED provides fiber optic users with high coupled power and wide bandwidth in a low cost package.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +115°C
Operating Temperature Range ..... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-In**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Fiber | Refractive Index | N.A. | Typical Coupled Power $I_F$ = 100mA @ 25°C OPF390D | OPF390C | OPF390B | OPF390A |
|---|---|---|---|---|---|---|
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 18µW | 25µW |
| 62.5/125µm | Graded | 0.28 | 27µW | 35µW | 45µW | 75µW |
| 100/140µm | Graded | 0.29 | 58µW | 85µW | 115µW | 170µW |
| 200/300µm* | Step | 0.41 | 290µW | 450µW | 545µW | 650µW |

*PCS - Plastic Clad Silica

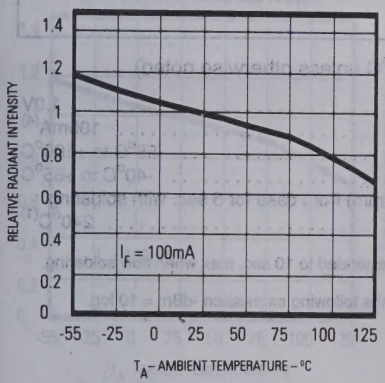
# Types OPF390A, OPF390B, OPF390C, OPF390D

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

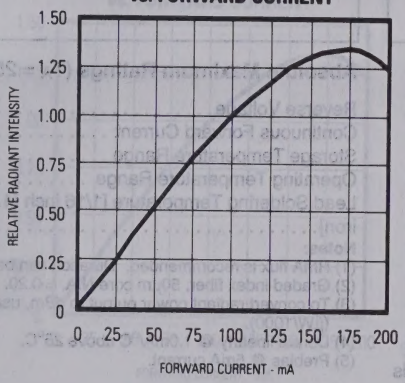
| Symbol | Parameter | Dot | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF390D (Silver) | 5.0 | 7.5 | | | |
| | | OPF390C (Black) | 10.0 | 12.5 | | μW | $I_F$ = 100mA[2] |
| | | OPF390B (Green) | 15.0 | 18.0 | | | |
| | | OPF390A (Orange) | 20.0 | 25.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 4.5 | 6.0 | ns | $I_F$ = 100mA, 10%-90%[5] |
| $t_f$ | Output Fall Time | | | 4.5 | 6.0 | ns | $I_F$ = 100mA, 90%-10%[5] |

**TYPICAL PERFORMANCE CURVES**

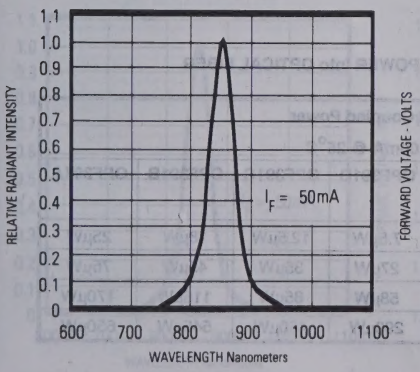
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



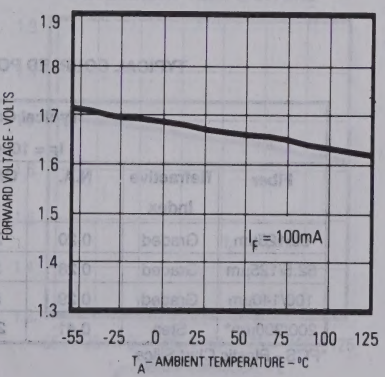

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

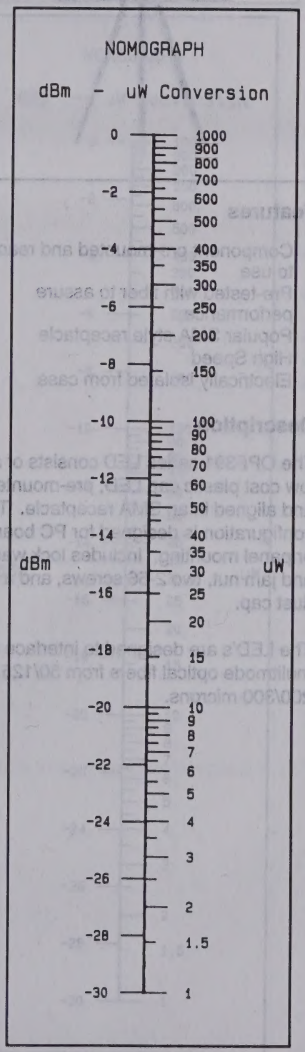



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



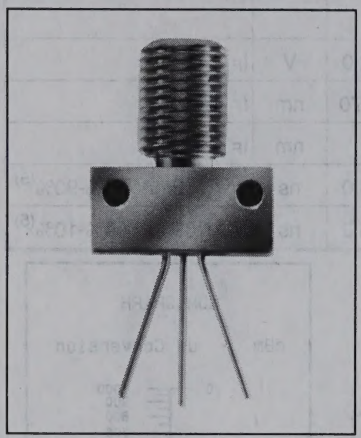



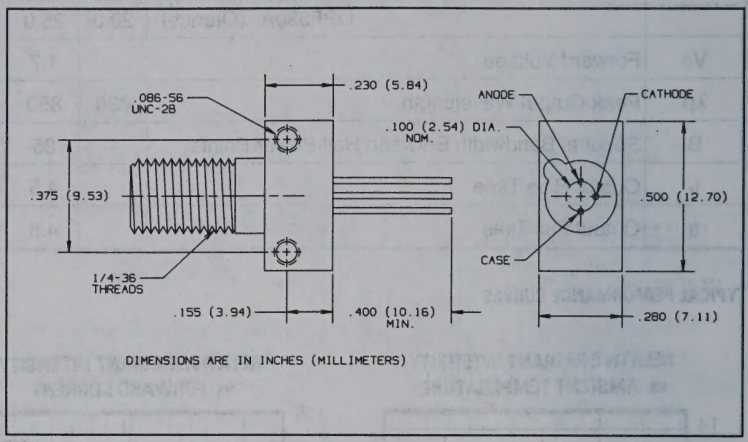

FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

# Fiber Optic GaAlAs High Speed LED in SMA Receptacle
# Types OPF391A, OPF391B, OPF391C, OPF391D






## Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- High Speed
- Electrically isolated from case

## Description

The OPF391 series LED consists of a low cost plastic cap LED, pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with mulitmode optical fibers from 50/125 to 200/300 microns.

## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +100°C
Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-In**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Fiber | Refractive Index | N.A. | Typical Coupled Power $I_F$ = 100mA @ 25°C OPF391D | OPF391C | OPF391B | OPF391A |
|---|---|---|---|---|---|---|
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 18µW | 25µW |
| 62.5/125µm | Graded | 0.28 | 27µW | 35µW | 45µW | 75µW |
| 100/140µm | Graded | 0.29 | 58µW | 85µW | 115µW | 170µW |
| 200/300µm* | Step | 0.41 | 290µW | 450µW | 545µW | 650µW |

*PCS - Plastic Clad Silica

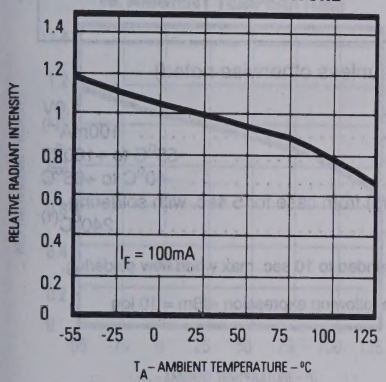
# Types OPF391A, OPF391B, OPF391C, OPF391D

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

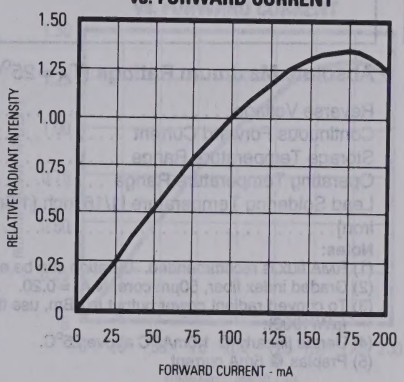
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF391D | 5.0 | 7.5 | | μW | $I_F$ = 100mA(2) |
| | | OPF391C | 10.0 | 12.5 | | | |
| | | OPF391B | 15.0 | 18.0 | | | |
| | | OPF391A | 20.0 | 25.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 4.5 | 6.0 | ns | $I_F$ = 100mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | | 4.5 | 6.0 | ns | $I_F$ = 100mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

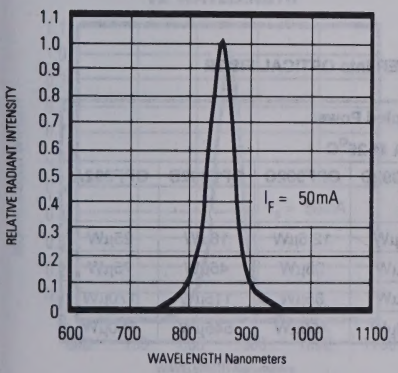
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



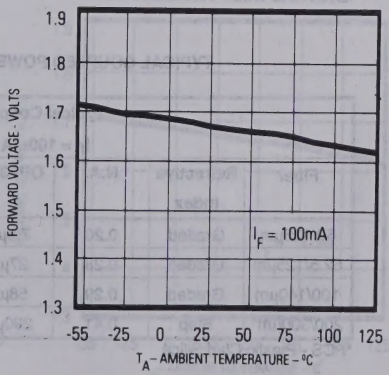

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

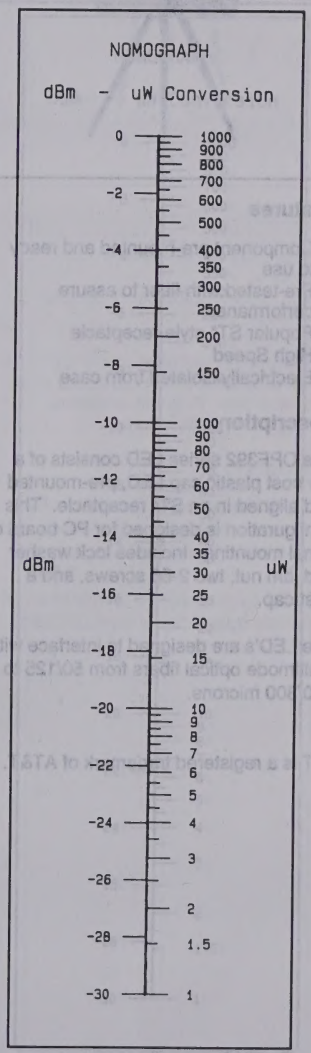



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



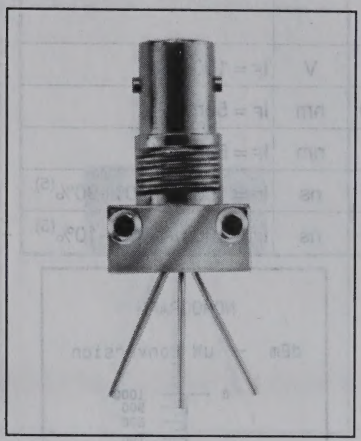



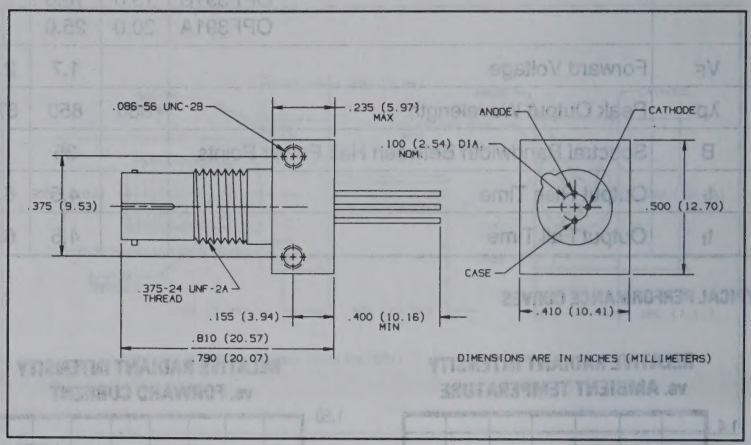

FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

# Fiber Optic GaAlAs High Speed LED in ST* Receptacle
# Types OPF392A, OPF392B, OPF392C, OPF392D






## Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle
- High Speed
- Electrically isolated from case

## Description

The OPF392 series LED consists of a low cost plastic cap LED, pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

*ST is a registered trademark of AT&T.

## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +100°C
Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-In**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Typical Coupled Power $I_F$ = 100mA @ 25°C | | | | | | |
|---|---|---|---|---|---|---|
| Fiber | Refractive Index | N.A. | OPF392D | OPF392C | OPF392B | OPF392A |
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 18µW | 25µW |
| 62.5/125µm | Graded | 0.28 | 27µW | 35µW | 45µW | 75µW |
| 100/140µm | Graded | 0.29 | 58µW | 85µW | 115µW | 170µW |
| 200/300µm* | Step | 0.41 | 290µW | 450µW | 545µW | 650µW |

*PCS - Plastic Clad Silica

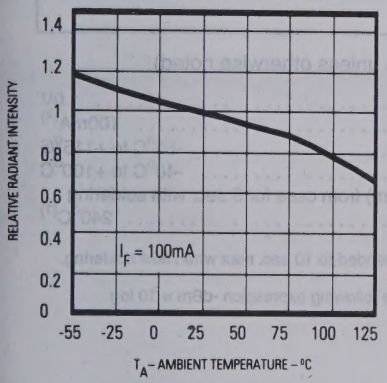
# Types OPF392A, OPF392B, OPF392C, OPF392D

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

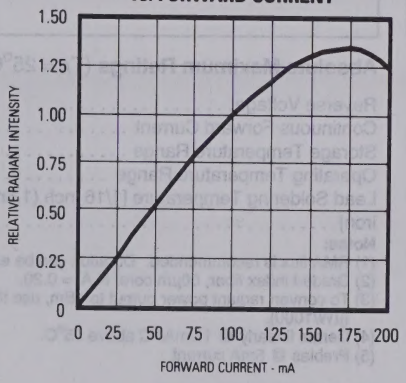
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF392D | 5.0 | 7.5 | | µW | $I_F$ = 100mA(2) |
| | | OPF392C | 10.0 | 12.5 | | | |
| | | OPF392B | 15.0 | 18.0 | | | |
| | | OPF392A | 20.0 | 25.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 4.5 | 6.0 | ns | $I_F$ = 100mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | | 4.5 | 6.0 | ns | $I_F$ = 100mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

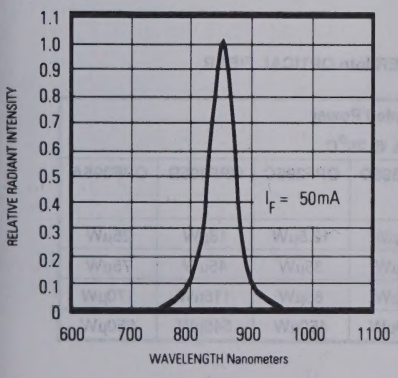
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



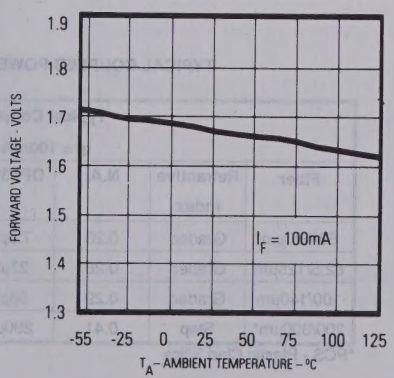

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

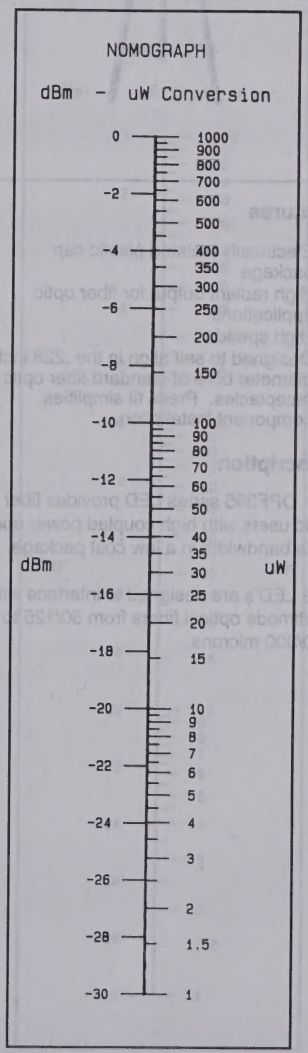



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**

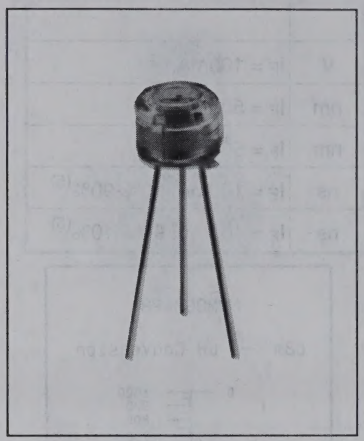


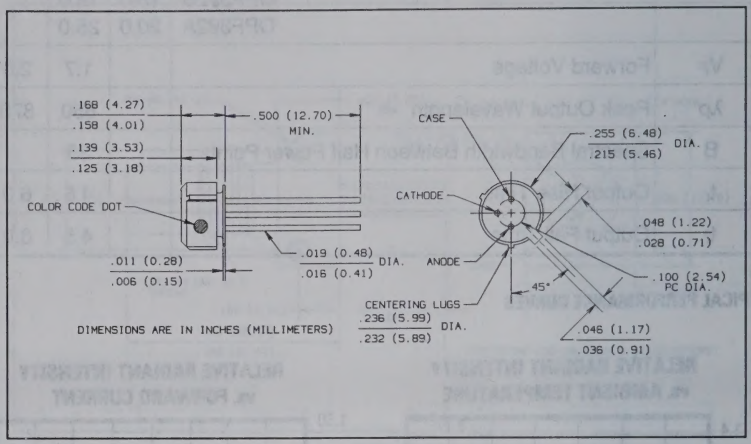




FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Fiber Optic GaAlAs High Speed LED
## Types OPF395A, OPF395B, OPF395C, OPF395D






### Features

- Electrically isolated plastic cap package
- High radiant output for fiber optic applications
- High speed
- Designed to self align in the .228 inch diameter bore of standard fiber optic receptacles. Press fit simplifies component installation.

### Description

The OPF395 series LED provides fiber optic users with high coupled power and wide bandwidth in a low cost package.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 1.0V |
| Continuous Forward Current | 100mA(4) |
| Storage Temperature Range | -55°C to +115°C |
| Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-in**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Fiber | Refractive Index | N.A. | Typical Coupled Power $I_F$ = 100mA @ 25°C OPF395D | OPF395C | OPF395B | OPF395A |
|---|---|---|---|---|---|---|
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 18µW | 25µW |
| 62.5/125µm | Graded | 0.28 | 27µW | 35µW | 45µW | 75µW |
| 100/140µm | Graded | 0.29 | 58µW | 85µW | 115µW | 170µW |
| 200/300µm* | Step | 0.41 | 290µW | 450µW | 545µW | 650µW |

*PCS - Plastic Clad Silica

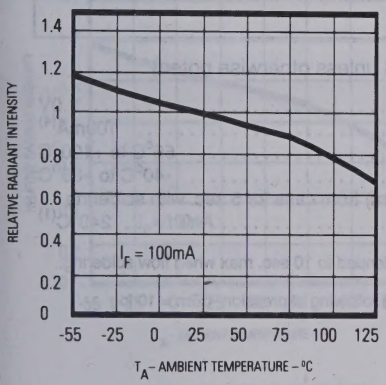
# Types OPF395A, OPF395B, OPF395C, OPF395D

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

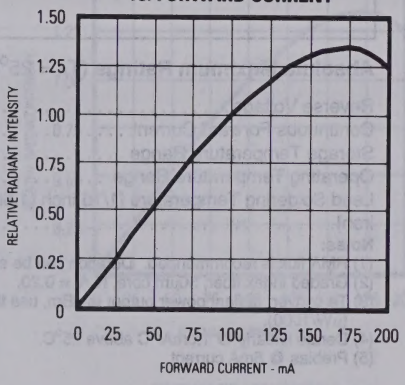
| Symbol | Parameter | Dot | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF395D (Silver) | 5.0 | 7.5 | | µW | $I_F$ = 100mA[2] |
| | | OPF395C (Black) | 10.0 | 12.5 | | | |
| | | OPF395B (Green) | 15.0 | 18.0 | | | |
| | | OPF395A (Orange) | 20.0 | 25.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 3.5 | 4.5 | ns | $I_F$ = 100mA, 10%-90%[5] |
| $t_f$ | Output Fall Time | | | 3.5 | 4.5 | ns | $I_F$ = 100mA, 90%-10%[5] |

**TYPICAL PERFORMANCE CURVES**

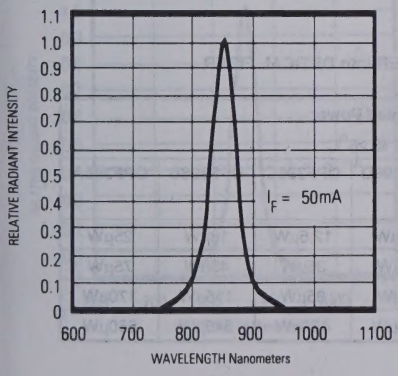
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



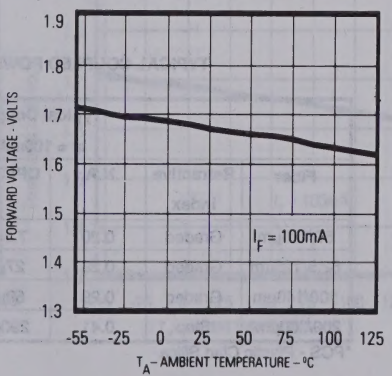

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

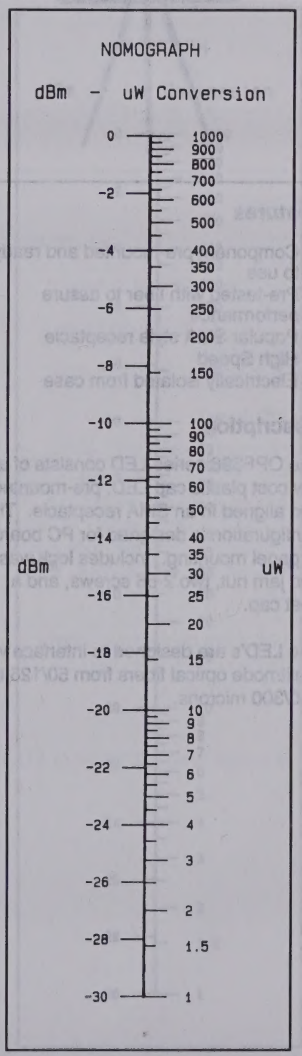



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**

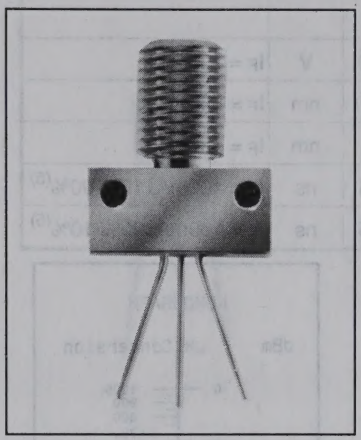


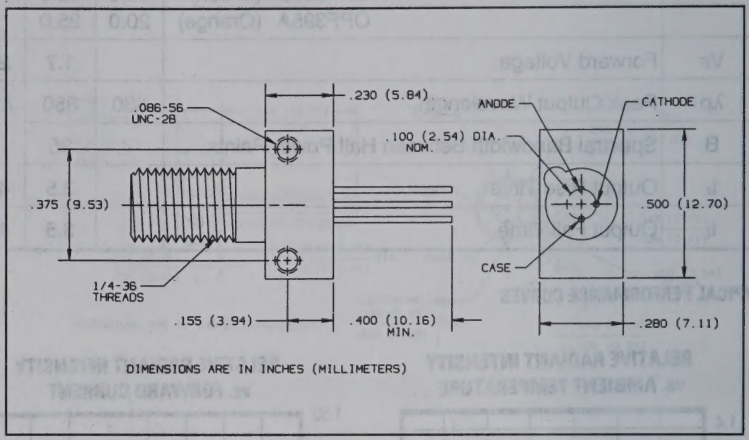




FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Fiber Optic GaAlAs High Speed LED in SMA Receptacle
# Types OPF396A, OPF396B, OPF396C, OPF396D






## Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- High Speed
- Electrically isolated from case

## Description

The OPF396 series LED consists of a low cost plastic cap LED, pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with mulitmode optical fibers from 50/125 to 200/300 microns.

## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +100°C
Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-In**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Typical Coupled Power $I_F$ = 100mA @ 25°C | | | | | | |
|---|---|---|---|---|---|---|
| Fiber | Refractive Index | N.A. | OPF396D | OPF396C | OPF396B | OPF396A |
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 18µW | 25µW |
| 62.5/125µm | Graded | 0.28 | 27µW | 35µW | 45µW | 75µW |
| 100/140µm | Graded | 0.29 | 58µW | 85µW | 115µW | 170µW |
| 200/300µm* | Step | 0.41 | 290µW | 450µW | 545µW | 650µW |

*PCS - Plastic Clad Silica

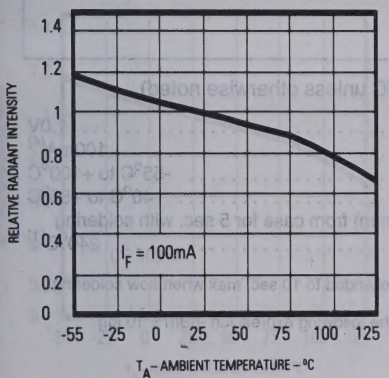
# Types OPF396A, OPF396B, OPF396C, OPF396D

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

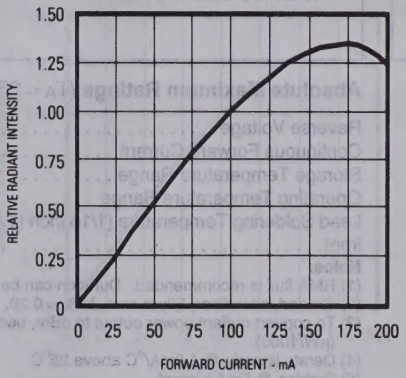
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF396D | 5.0 | 7.5 | | | |
| | | OPF396C | 10.0 | 12.5 | | µW | $I_F$ = 100mA(2) |
| | | OPF396B | 15.0 | 18.0 | | | |
| | | OPF396A | 20.0 | 25.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 3.5 | 4.5 | ns | $I_F$ = 100mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | | 3.5 | 4.5 | ns | $I_F$ = 100mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

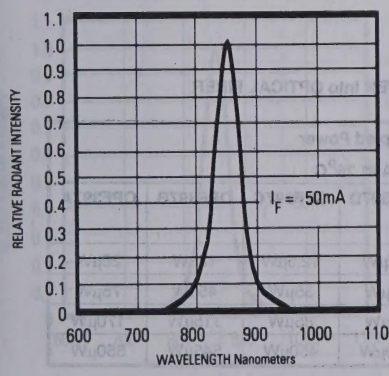
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



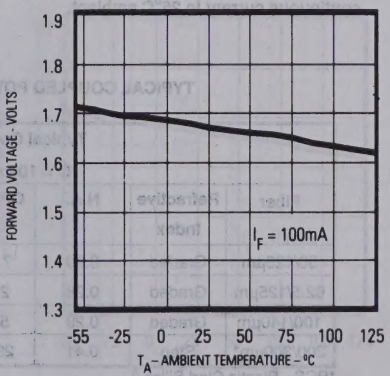

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

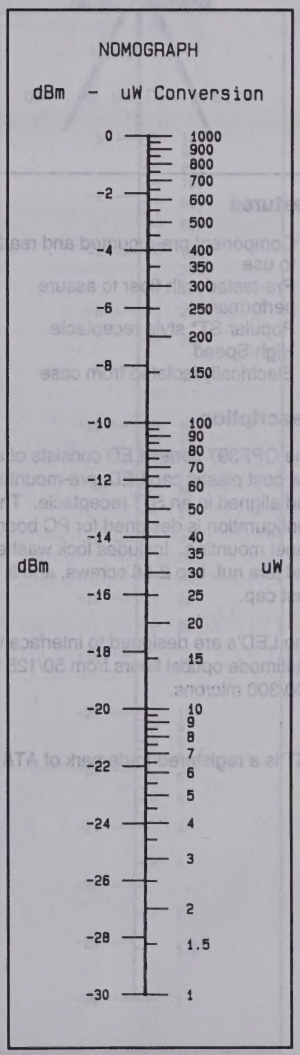



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**

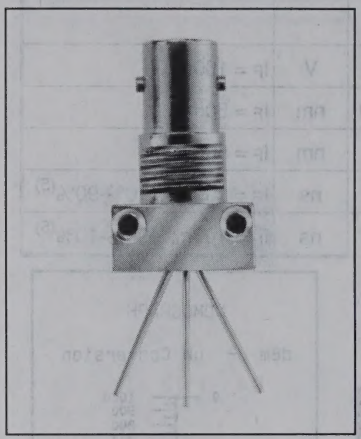


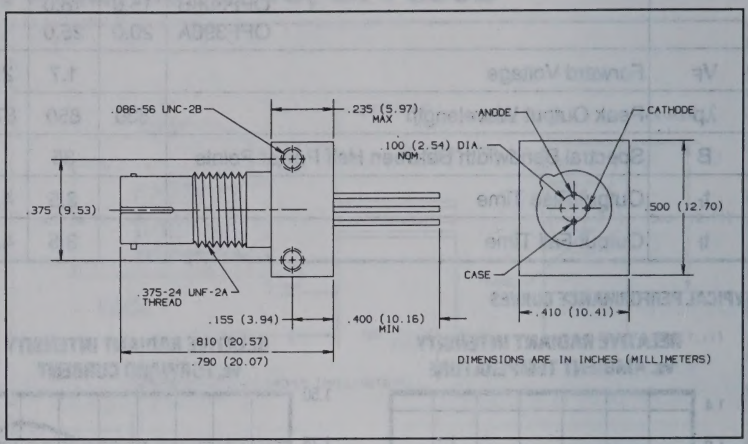




FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Fiber Optic GaAlAs High Speed LED in ST* Receptacle
# Types OPF397A, OPF397B, OPF397C, OPF397D






## Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle
- High Speed
- Electrically isolated from case

## Description

The OPF397 series LED consists of a low cost plastic cap LED, pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

*ST is a registered trademark of AT&T.

## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +100°C
Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**LED Burn-in**

**All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.**

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Fiber | Refractive Index | N.A. | Typical Coupled Power $I_F$ = 100mA @ 25°C OPF397D | OPF397C | OPF397B | OPF397A |
|---|---|---|---|---|---|---|
| 50/125µm | Graded | 0.20 | 7.5µW | 12.5µW | 18µW | 25µW |
| 62.5/125µm | Graded | 0.28 | 27µW | 35µW | 45µW | 75µW |
| 100/140µm | Graded | 0.29 | 58µW | 85µW | 115µW | 170µW |
| 200/300µm* | Step | 0.41 | 290µW | 450µW | 545µW | 650µW |

*PCS - Plastic Clad Silica

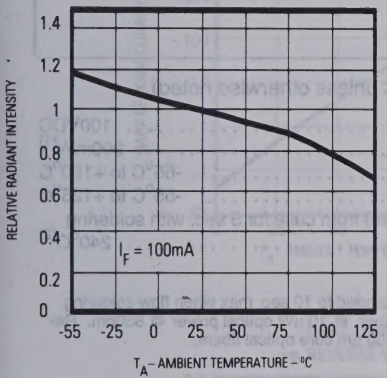
# Types OPF397A, OPF397B, OPF397C, OPF397D

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

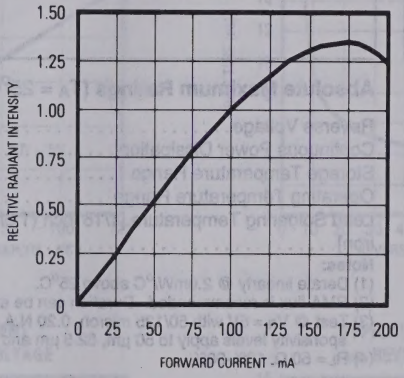
| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OPF397D | 5.0 | 7.5 | | µW | $I_F$ = 100mA[2] |
| | | OPF397C | 10.0 | 12.5 | | | |
| | | OPF397B | 15.0 | 18.0 | | | |
| | | OPF397A | 20.0 | 25.0 | | | |
| $V_F$ | Forward Voltage | | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Bandwidth Between Half Power Points | | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | | 3.5 | 4.5 | ns | $I_F$ = 100mA, 10%-90%[5] |
| $t_f$ | Output Fall Time | | | 3.5 | 4.5 | ns | $I_F$ = 100mA, 90%-10%[5] |

**TYPICAL PERFORMANCE CURVES**

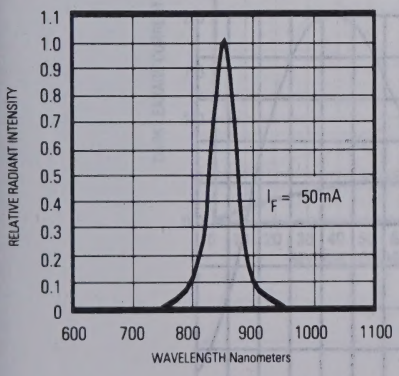
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



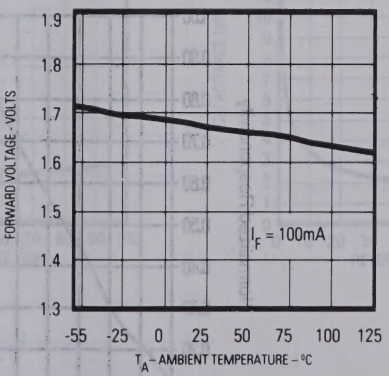

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

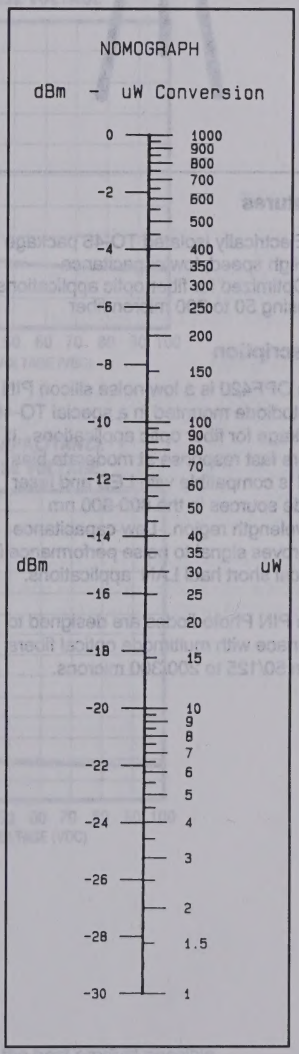



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



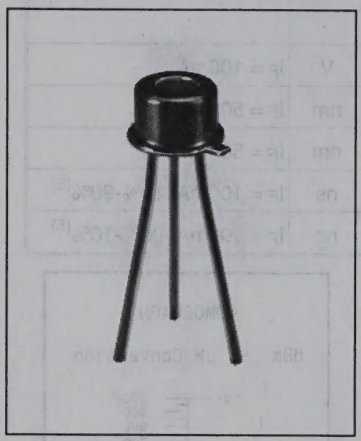



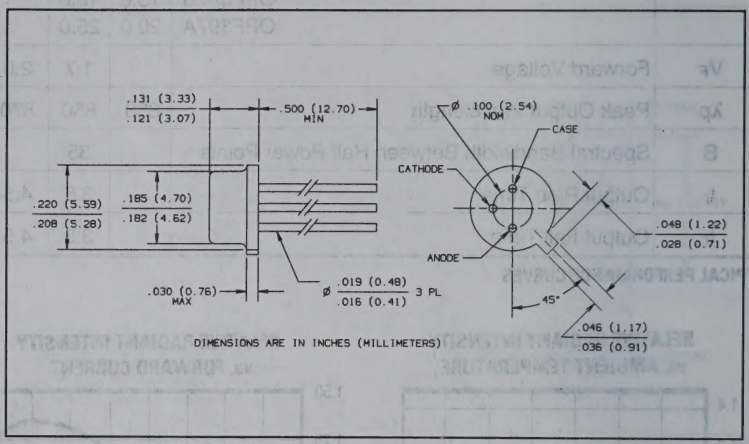

FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Fiber Optic PIN Photodiode
## Type OPF420






### Features

- Electrically isolated TO-46 package
- High speed, low capacitance
- Optimized for fiber optic applications using 50 to 200 micron fiber

### Description

The OPF420 is a low noise silicon PIN photodiode mounted in a special TO-46 package for fiber optic applications. It offers fast response at moderate bias and is compatible with LED and laser diode sources in the 800-900 nm wavelength region. Low capacitance improves signal to noise performance in typical short haul LAN applications.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

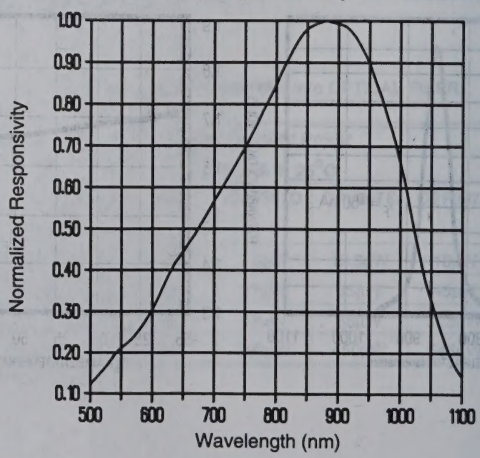
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.
(4) $R_L$ = 50 Ω, 10%-90%

### Typical Performance Curves

**Relative Spectral Response**



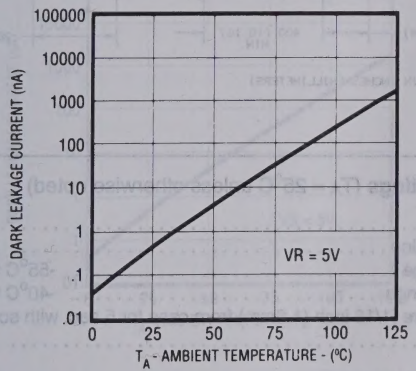
# Type OPF420

**Electrical Characteristics** ($T_A$ = 25°C unless outherwise noted)

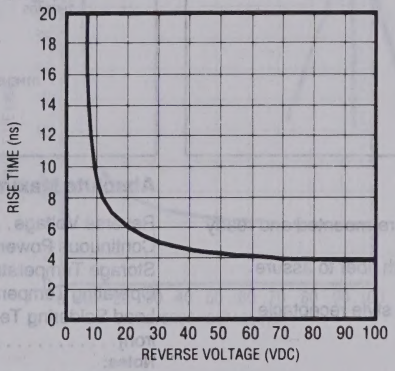
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0V[3] |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0V |
| $\lambda p$ | Peak Response Wavelength | | 880 | | nm | |
| $t_r$ | Output Rise Time | | 6.0 | | ns | $V_R$ = 15.0V [4] |
| $C_T$ | Total Capacitance | | 3.0 | | pF | $V_R$ = 20.0V |
| FoV | Field of View | | 80 | | Deg. | |

**TYPICAL PERFORMANCE CURVES**

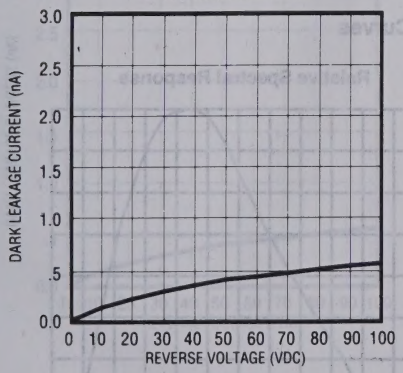
**DARK CURRENT vs. AMBIENT TEMPERATURE**



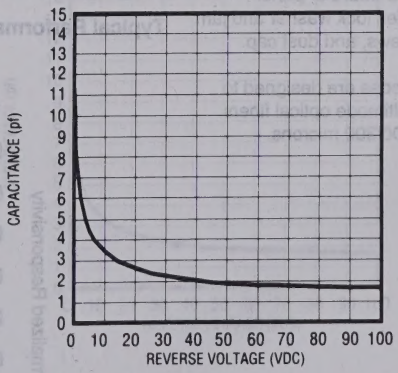

**RISE TIME vs. REVERSE VOLTAGE**




**DARK CURRENT vs. REVERSE VOLTAGE**



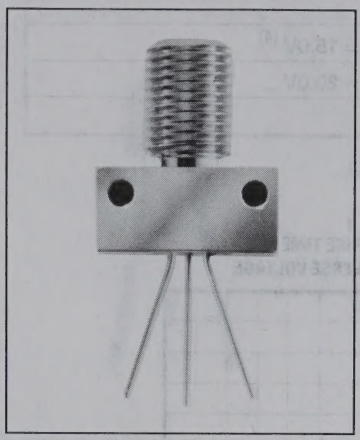

**TYPICAL CAPACITANCE vs. REVERSE VOLTAGE**

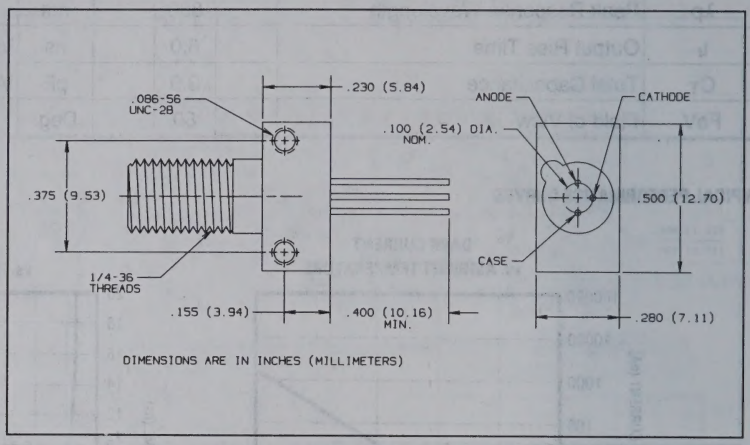



FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Fiber Optic PIN Photodiode in SMA Receptacle
# Type OPF421






## Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle

## Description

The OPF421 consists of a hermetic PIN photodiode pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

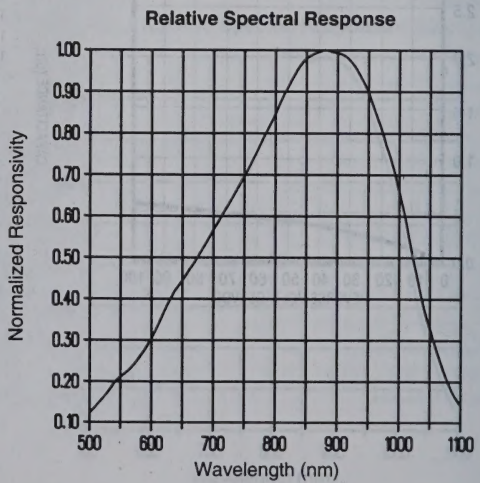
The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

## Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100V |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -55°C to +125°C |
| Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850nm. Responsivity levels apply to 50 µm, 62.5 µm, and 100 µm core optical fibers.
(4) $R_L$ = 50 Ω, 10%-90%.

## Typical Performance Curves




Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

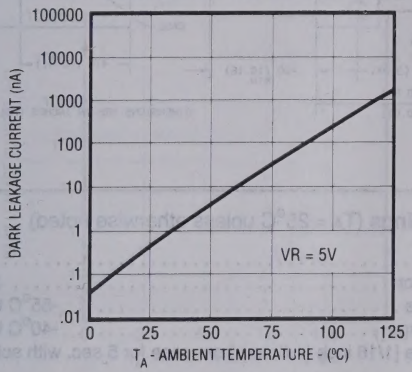
# Type OPF421

**Electrical Characteristics** ($T_A$ = 25°C unless outherwise noted)

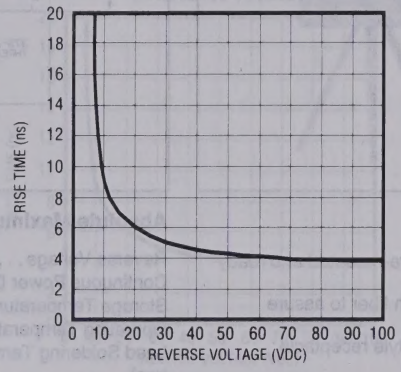
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0V[3] |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0V |
| λp | Peak Response Wavelength | | 880 | | nm | |
| $t_r$ | Output Rise Time | | 6.0 | | ns | $V_R$ = 15.0V [4] |
| $C_T$ | Total Capacitance | | 3.0 | | pF | $V_R$ = 20.0V |

**TYPICAL PERFORMANCE CURVES**

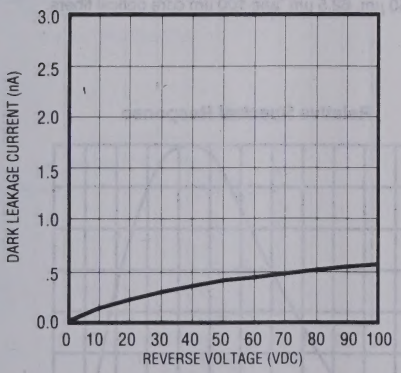
**DARK CURRENT vs. AMBIENT TEMPERATURE**



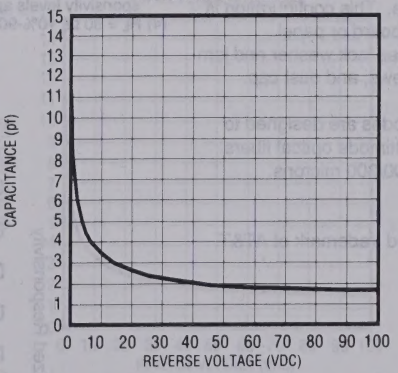

**RISE TIME vs. REVERSE VOLTAGE**




**DARK CURRENT vs. REVERSE VOLTAGE**




**TYPICAL CAPACITANCE vs. REVERSE VOLTAGE**

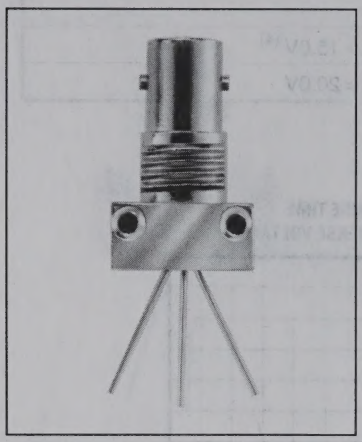


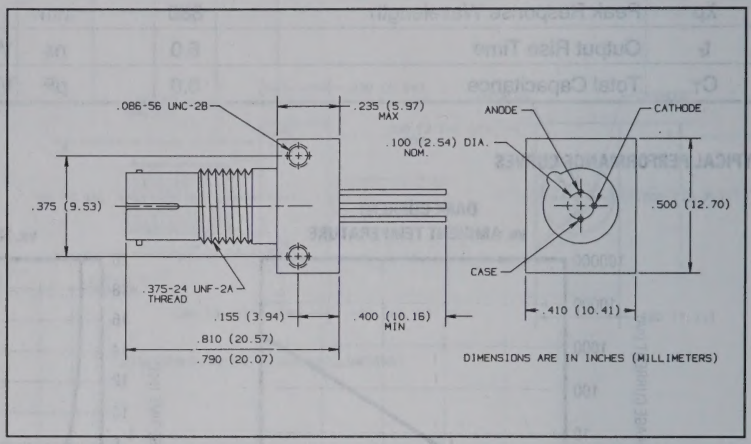

FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Fiber Optic PIN Photodiode in ST* Receptacle
# Type OPF422






## Features

- Component pre-mounted and ready for use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle

## Description

The OPF422 consists of a hermetic PIN photodiode pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

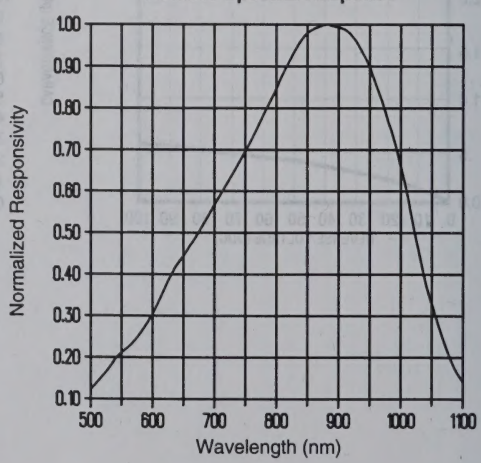
*ST is a registered trademark of AT&T.

## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -55°C to +125°C |
| Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850nm. Responsivity levels apply to 50 µm, 62.5 µm, and 100 µm core optical fibers.
(4) $R_L$ = 50 Ω, 10%-90%.

### Relative Spectral Response




Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

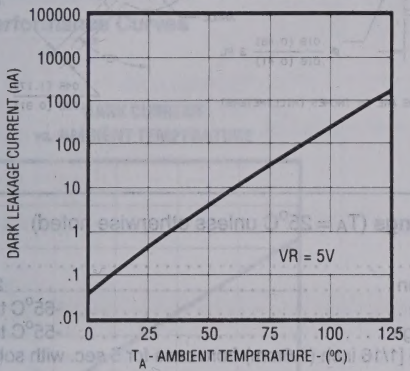
# Type OPF422

**Electrical Characteristics** ($T_A$ = 25°C unless outherwise noted)

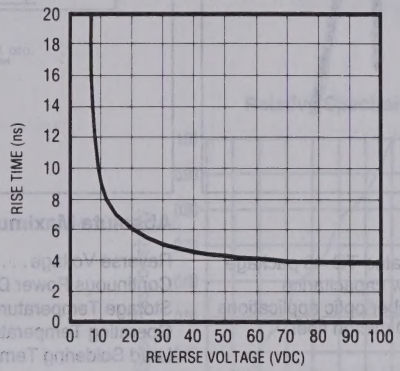
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0V[3] |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0V |
| $\lambda p$ | Peak Response Wavelength | | 880 | | nm | |
| $t_r$ | Output Rise Time | | 6.0 | | ns | $V_R$ = 15.0V[4] |
| $C_T$ | Total Capacitance | | 3.0 | | pF | $V_R$ = 20.0V |

**TYPICAL PERFORMANCE CURVES**

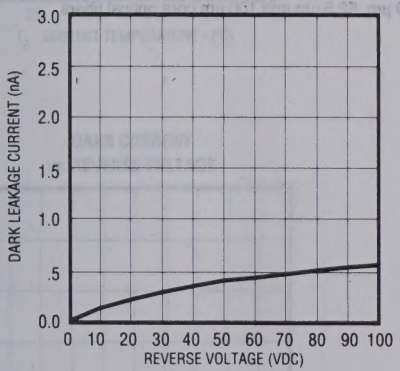
**DARK CURRENT vs. AMBIENT TEMPERATURE**



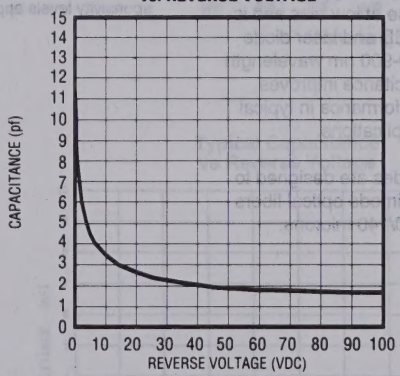

**RISE TIME vs. REVERSE VOLTAGE**




**DARK CURRENT vs. REVERSE VOLTAGE**

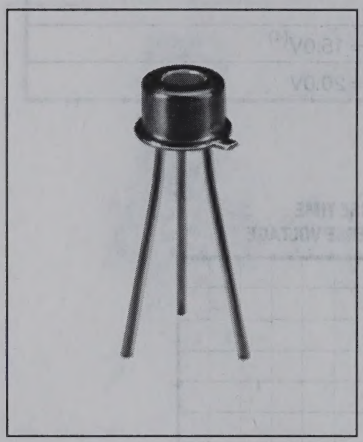


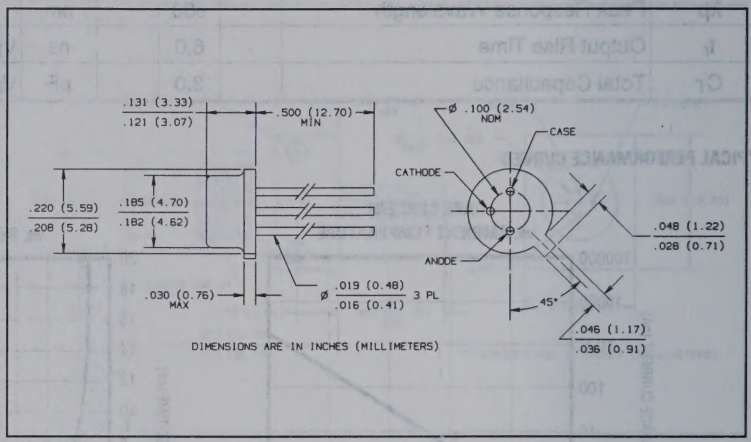

**TYPICAL CAPACITANCE vs. REVERSE VOLTAGE**




FIBER OPTIC COMPONENTS

# Fiber Optic High Speed PIN Photodiode
## Type OPF430






### Features

- Electrically isolated TO-46 package
- High speed, low capacitance
- Optimized for fiber optic applications using 50 to 100 micron fiber

### Description

The OPF430 is a low noise silicon PIN photodiode mounted in a special TO-46 package for fiber optics applications. It offers fast response at low bias and is compatible with LED and laser diode sources in the 800-900 nm wavelength region. Low capacitance improves signal to noise performance in typical short haul LAN applications.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0 mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.

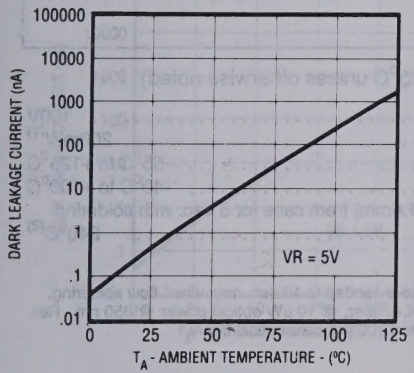
# Type OPF430

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

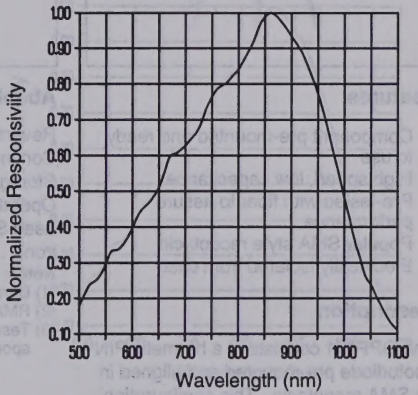
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0V[3] |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0V |
| λp | Peak Response Wavelength | | 860 | | nm | |
| $t_r$ | Output Rise Time | | 0.6 | | ns | $V_R$ = 50.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 1.0 | | ns | $V_R$ = 15.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 2.0 | | ns | $V_R$ = 5.0V, $R_L$ = 50Ω, 10%-90% |
| $C_T$ | Total Capacitance | | 1.5 | 2.0 | pF | $V_R$ = 5.0V |
| FoV | Field of View | | 80 | | Deg. | |

## Typical Performance Curves

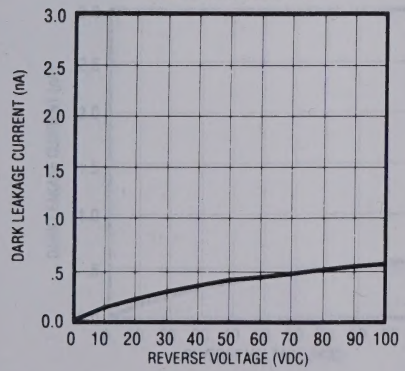
**DARK CURRENT vs. AMBIENT TEMPERATURE**



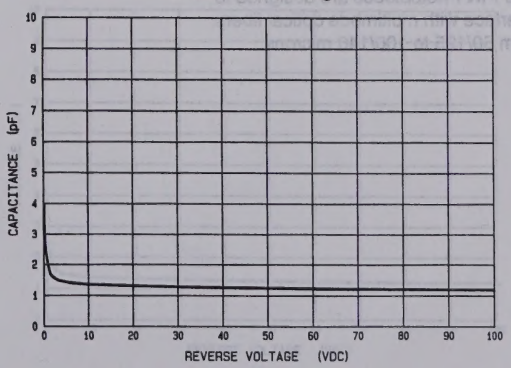

**Relative Spectral Response**




**DARK CURRENT vs. REVERSE VOLTAGE**




**Typical Capacitance vs Reverse Voltage**

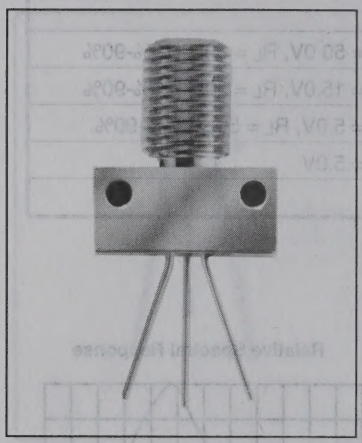


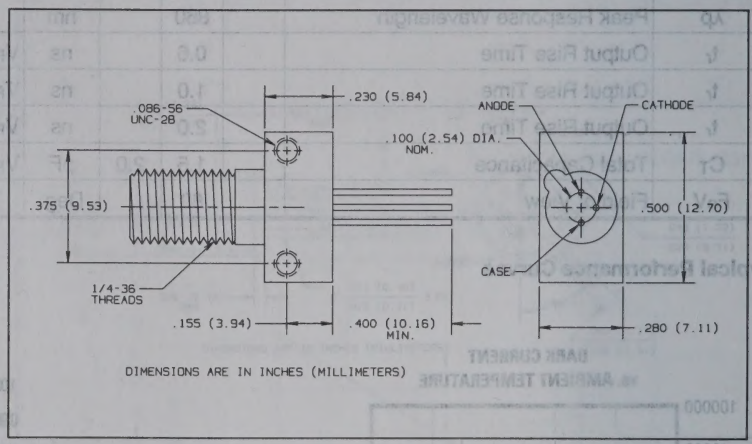

FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

# Fiber Optic High Speed PIN Photodiode in SMA Receptacle
# Type OPF431






## Features

- Component pre-mounted and ready to use
- High speed, low capacitance
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- Electrically isolated from case

## Description

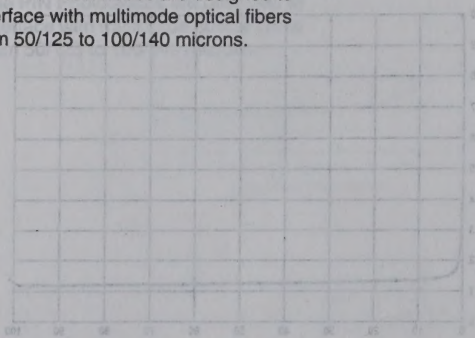
The OPF431 consists of a hermetic PIN photodiode pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

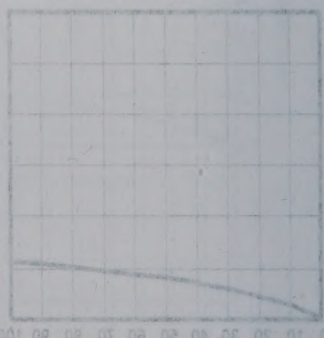
The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100V |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -55°C to +125°C |
| Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.



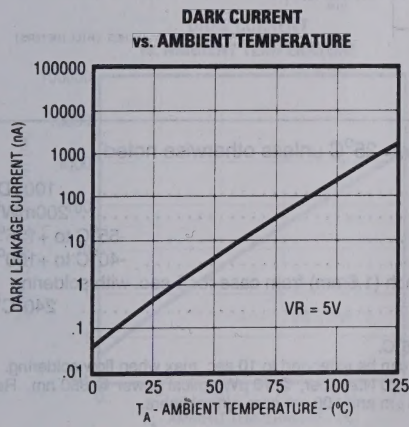


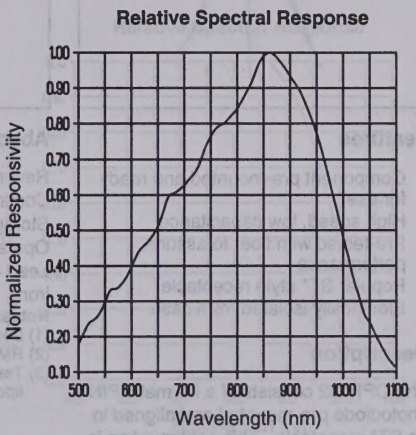
# Type OPF431

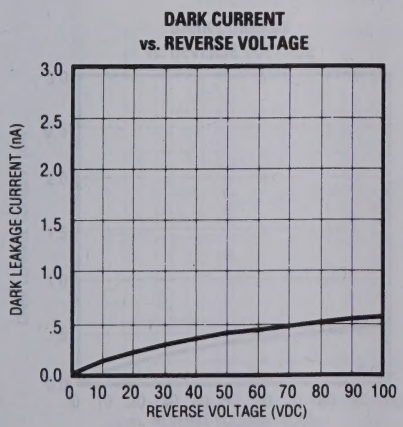
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

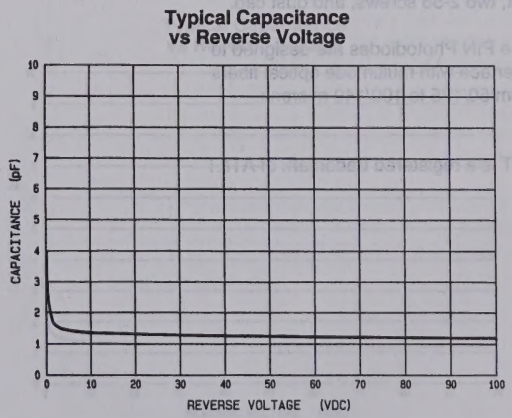
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0V[3] |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0V |
| λp | Peak Response Wavelength | | 860 | | nm | |
| $t_r$ | Output Rise Time | | 0.6 | | ns | $V_R$ = 50.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 1.0 | | ns | $V_R$ = 15.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 2.0 | | ns | $V_R$ = 5.0V, $R_L$ = 50Ω, 10%-90% |
| $C_T$ | Total Capacitance | | 1.5 | 2.0 | pF | $V_R$ = 5.0V |

**Typical Performance Curves**



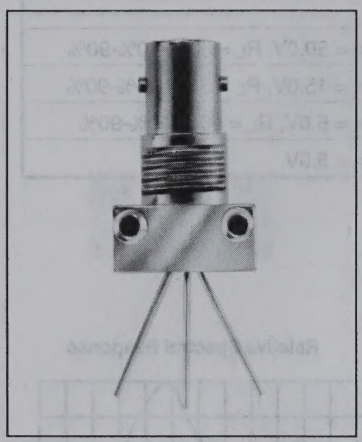



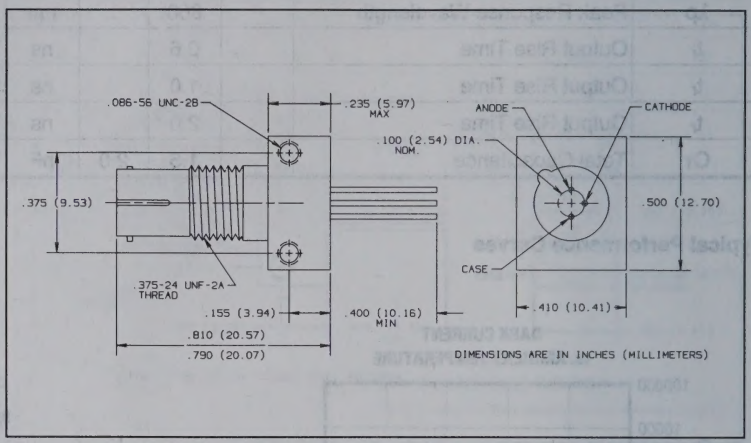

FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Fiber Optic High Speed PIN Photodiode in ST* Receptacle
## Type OPF432






### Features

- Component pre-mounted and ready for use
- High speed, low capacitance
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle
- Electrically isolated from case

### Description

The OPF432 consists of a hermetic PIN photodiode pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

*ST is a registered trademark of AT&T

### Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -55°C to +125°C |
| Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.

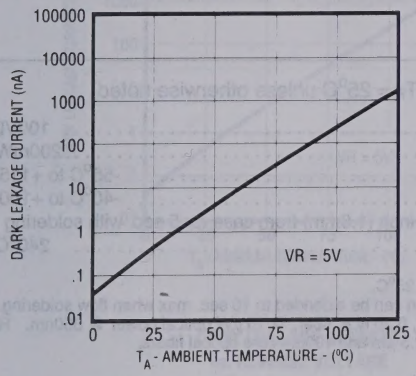
# Type OPF432

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

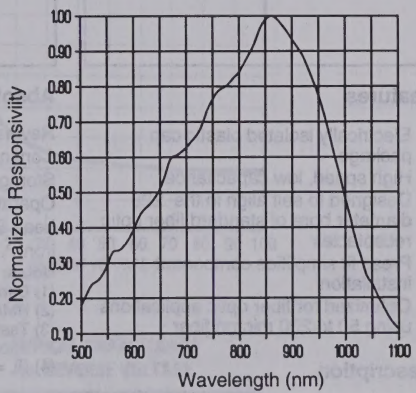
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0V(3) |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0V |
| λp | Peak Response Wavelength | | 860 | | nm | |
| $t_r$ | Output Rise Time | | 0.6 | | ns | $V_R$ = 50.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 1.0 | | ns | $V_R$ = 15.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 2.0 | | ns | $V_R$ = 5.0V, $R_L$ = 50Ω, 10%-90% |
| $C_T$ | Total Capacitance | | 1.5 | 2.0 | pF | $V_R$ = 5.0V |

## Typical Performance Curves

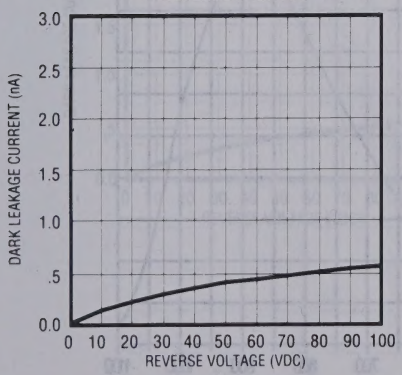
**DARK CURRENT vs. AMBIENT TEMPERATURE**



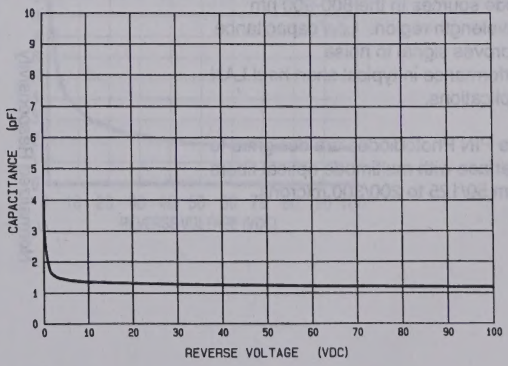

**Relative Spectral Response**




**DARK CURRENT vs. REVERSE VOLTAGE**

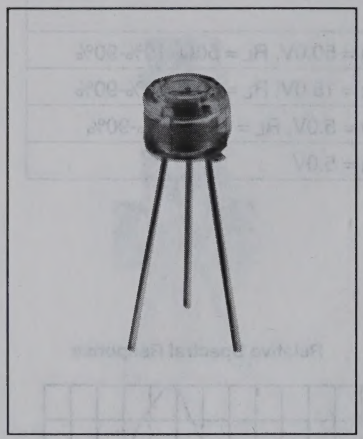


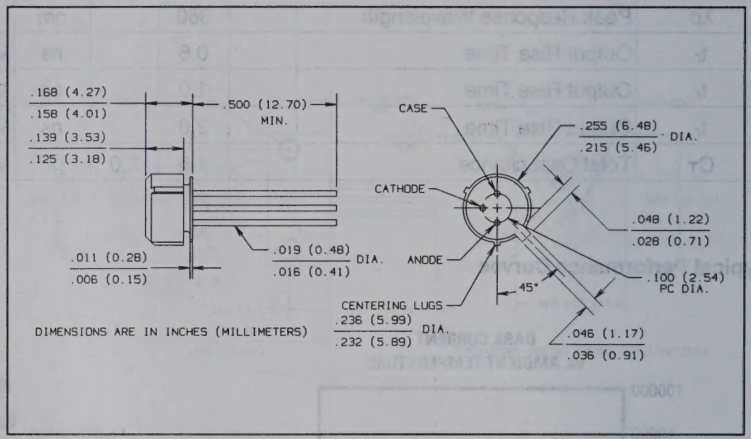

**Typical Capacitance vs Reverse Voltage**




FIBER OPTIC COMPONENTS

# Fiber Optic PIN Photodiode
## Type OPF470






### Features

- Electrically isolated plastic cap package
- High speed, low capacitance
- Designed to self align in the .228 diameter bore of standard fiber optic receptacles
- Press fit simplifies component installation
- Optimized for fiber optic applications using 50 to 200 micron fiber

### Description

The OPF470 is a low noise silicon PIN photodiode mounted in a low cost package for fiber optic applications. It offers fast response at moderate bias and is compatible with LED and laser diode sources in the 800-900 nm wavelength region. Low capacitance improves signal to noise performance in typical short haul LAN applications.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

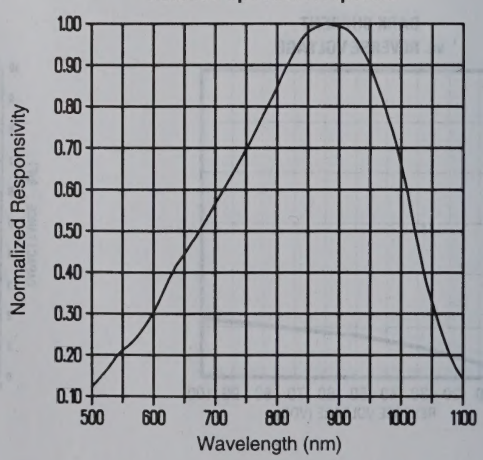
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -55°C to +115°C |
| Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850nm. Responsivity levels apply to 50 µm, 62.5 µm and 100µm core optical fibers.
(4) $R_L$ = 50 Ω, 10%-90%

### Typical Performance Curves

**Relative Spectral Response**




Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

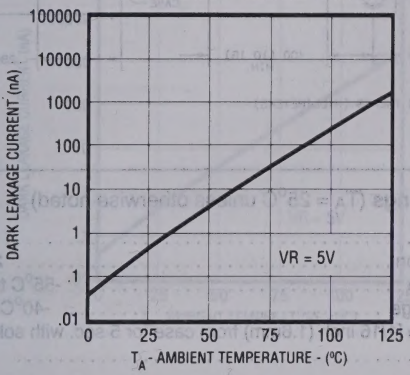
# Type OPF470

**Electrical Characteristics** ($T_A$ = 25°C unless outherwise noted)

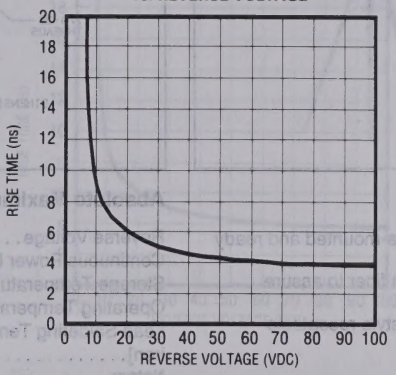
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0V(3) |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0V |
| λp | Peak Response Wavelength | | 880 | | nm | |
| $t_r$ | Output Rise Time | | 6.0 | | ns | $V_R$ = 15.0V(4) |
| $C_T$ | Total Capacitance | | 3.0 | | pF | $V_R$ = 20.0V |
| FoV | Field of View | | 80 | | Deg. | |

**TYPICAL PERFORMANCE CURVES**

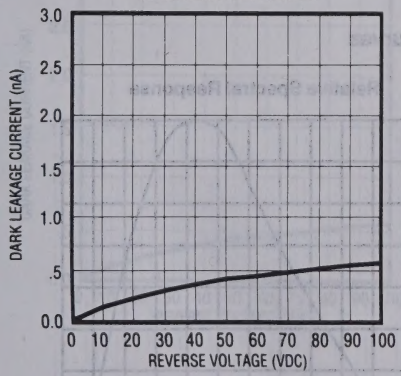
**DARK LEAKAGE CURRENT vs. AMBIENT TEMPERATURE**



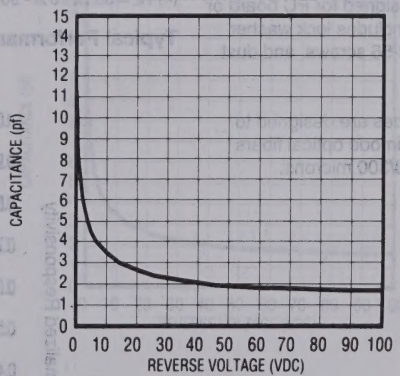

**RISE TIME vs. REVERSE VOLTAGE**




**DARK LEAKAGE CURRENT vs. REVERSE VOLTAGE**

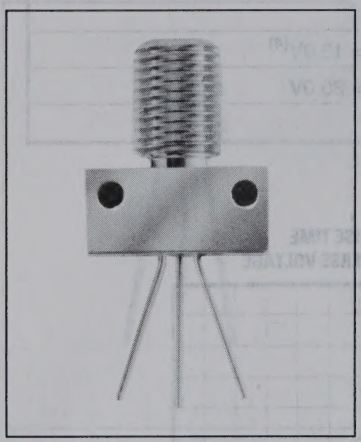


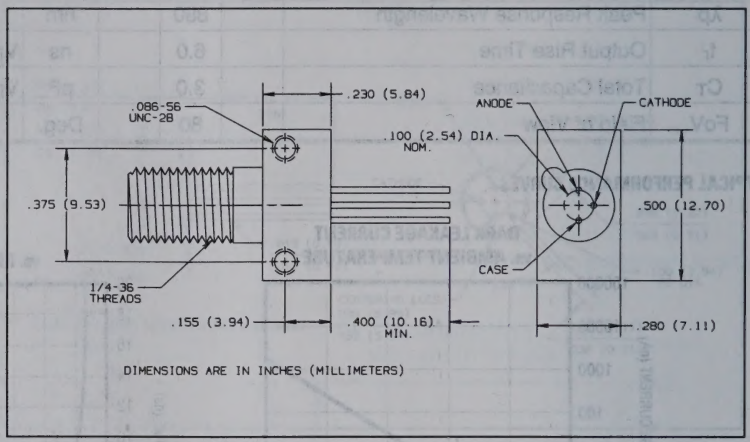

**TYPICAL CAPACITANCE vs. REVERSE VOLTAGE**




FIBER OPTIC COMPONENTS

# Fiber Optic PIN Photodiode in SMA Receptacle
# Type OPF471






## Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle

## Description

The OPF471 consists of a low cost plastic cap PIN photodiode pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

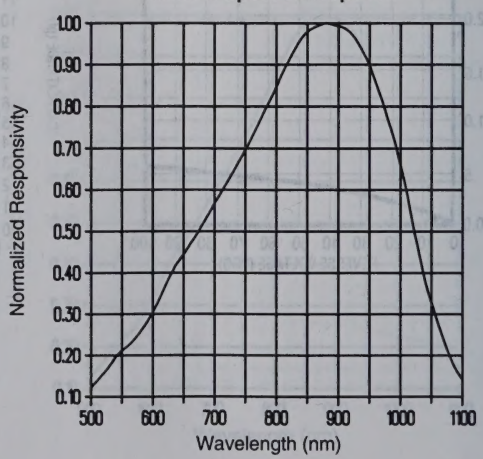
## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -55°C to +100°C |
| Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.
(4) $R_L$ = 50 Ω, 10% - 90%.

## Typical Performance Curves

**Relative Spectral Response**



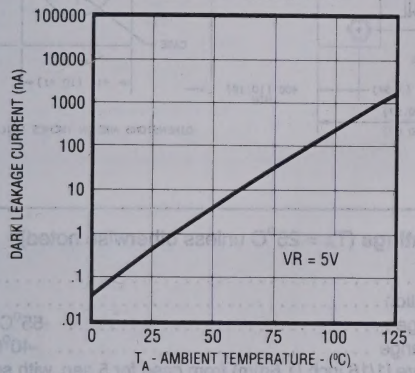
# Type OPF471

**Electrical Characteristics** ($T_A$ = 25°C unless outherwise noted)

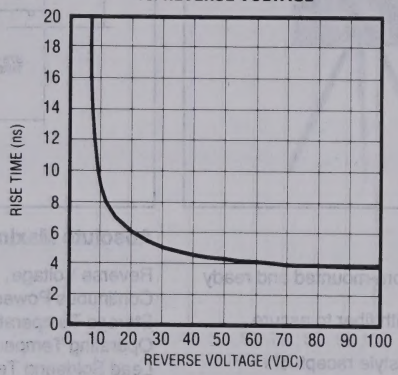
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0V[3] |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0V |
| λp | Peak Response Wavelength | | 880 | | nm | |
| $t_r$ | Output Rise Time | | 6.0 | | ns | $V_R$ = 15.0V[4] |
| $C_T$ | Total Capacitance | | 3.0 | | pF | $V_R$ = 20.0V |

**TYPICAL PERFORMANCE CURVES**

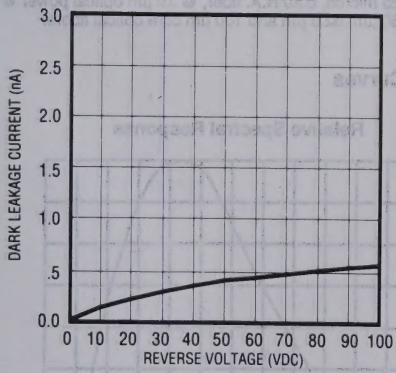
**DARK CURRENT vs. AMBIENT TEMPERATURE**



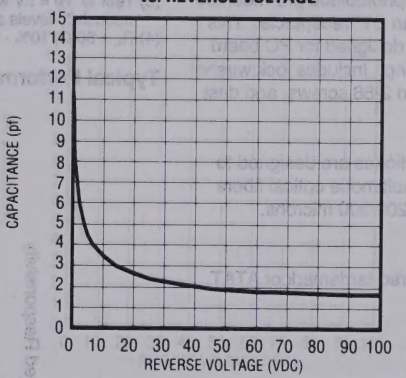

**RISE TIME vs. REVERSE VOLTAGE**




**DARK LEAKAGE CURRENT vs. REVERSE VOLTAGE**




**TYPICAL CAPACITANCE vs. REVERSE VOLTAGE**

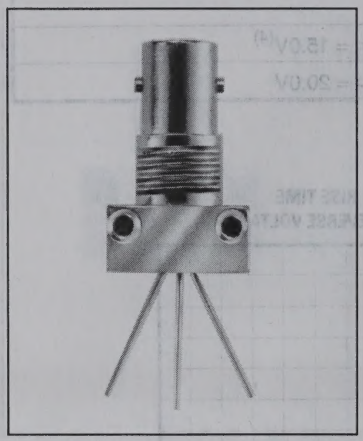


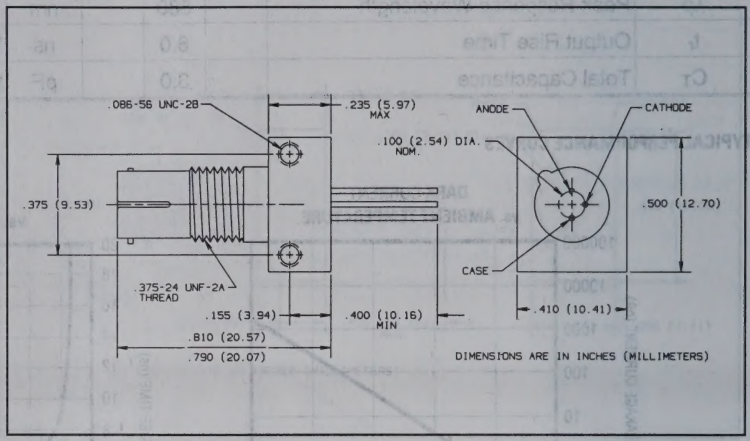

FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Fiber Optic PIN Photodiode in ST* Receptacle
# Type OPF472






## Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle

## Description

The OPF472 consists of a low cost plastic cap PIN photodiode pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

*ST is a registered tardemark of AT&T.

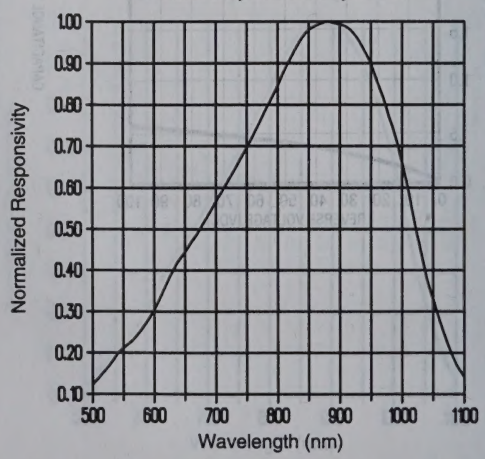
## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -55°C to +100°C |
| Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µm optical power @ 850nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.
(4) $R_L$ = 50 Ω, 10% - 90%.

## Typical Performance Curves

**Relative Spectral Response**

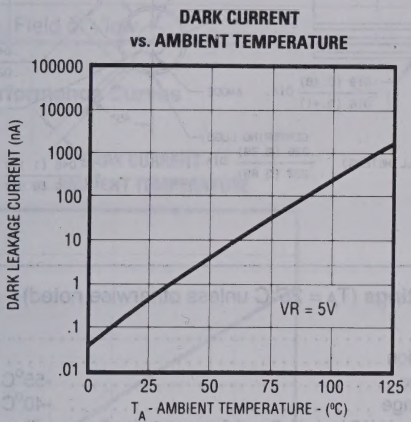


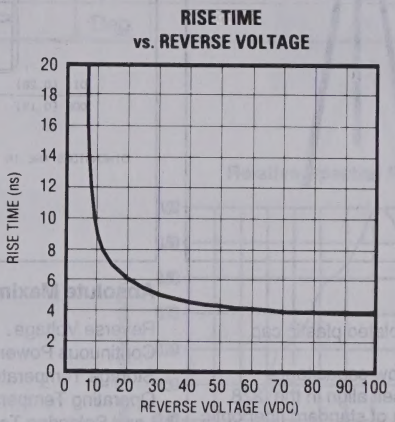
# Type OPF472

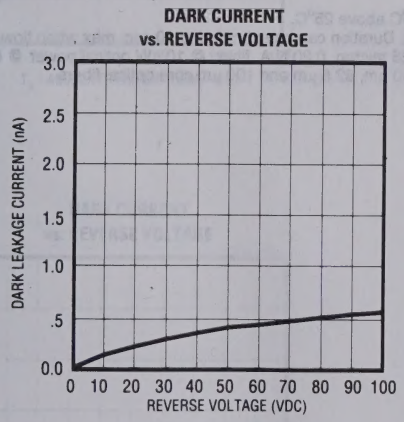
**Electrical Characteristics** ($T_A$ = 25°C unless outherwise noted)

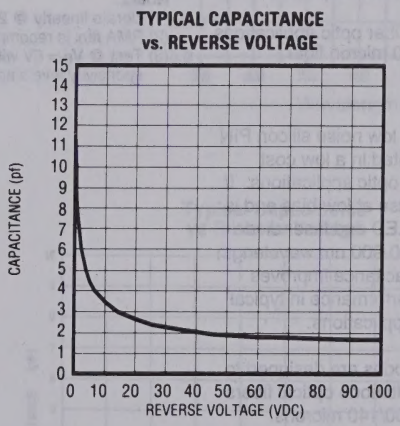
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0V(3) |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0V |
| λp | Peak Response Wavelength | | 880 | | nm | |
| $t_r$ | Output Rise Time | | 6.0 | | ns | $V_R$ = 15.0V(4) |
| $C_T$ | Total Capacitance | | 3.0 | | pF | $V_R$ = 20.0V |

**TYPICAL PERFORMANCE CURVES**



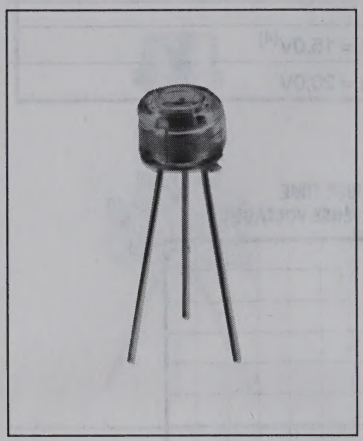



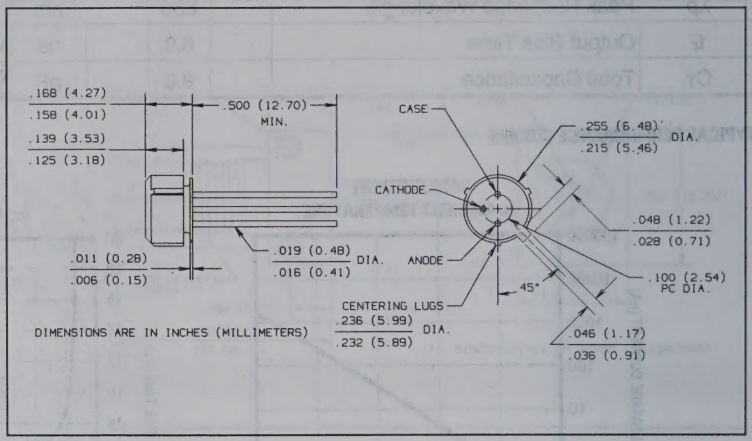




FIBER OPTIC COMPONENTS

# Fiber Optic High Speed PIN Photodiode
## Type OPF480






### Features

- Electrically isolated plastic cap package
- High speed, low capacitance
- Designed to self align in the .228 diameter bore of standard fiber optic receptacles
- Press fit simplifies component installation
- Optimized for fiber optic applications using 50 to 100 micron fiber

### Description

The OPF480 is a low noise silicon PIN photodiode mounted in a low cost package for fiber optic applications. It offers fast response at low bias and is compatible with LED and laser diode sources in the 800-900 nm wavelength region. Low capacitance improves signal to noise performance in typical short haul LAN applications.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -55°C to +115°C |
| Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.

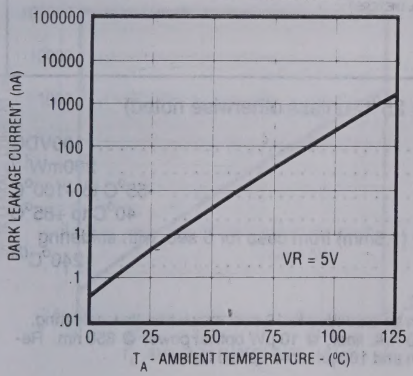
# Type OPF480

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

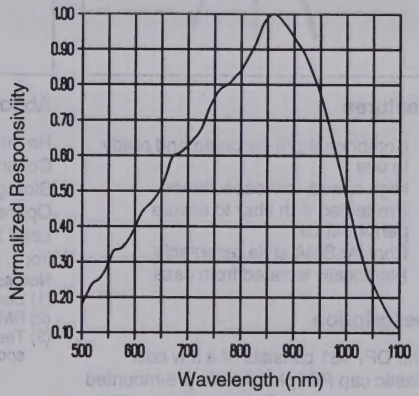
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0V[3] |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0V |
| λp | Peak Response Wavelength | | 860 | | nm | |
| $t_r$ | Output Rise Time | | 0.6 | | ns | $V_R$ = 50.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 1.0 | | ns | $V_R$ = 15.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 2.0 | | ns | $V_R$ = 5.0V, $R_L$ = 50Ω, 10%-90% |
| $C_T$ | Total Capacitance | | 1.5 | 2.0 | pF | $V_R$ = 5.0V |
| FoV | Field of View | | 80 | | Deg. | |

**Typical Performance Curves**

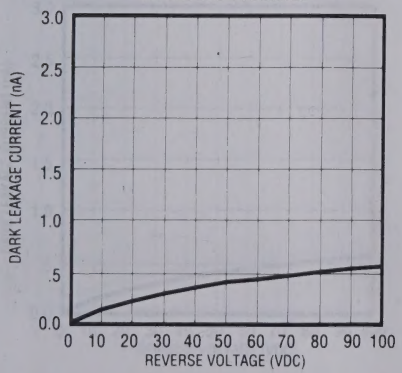
**DARK CURRENT vs. AMBIENT TEMPERATURE**



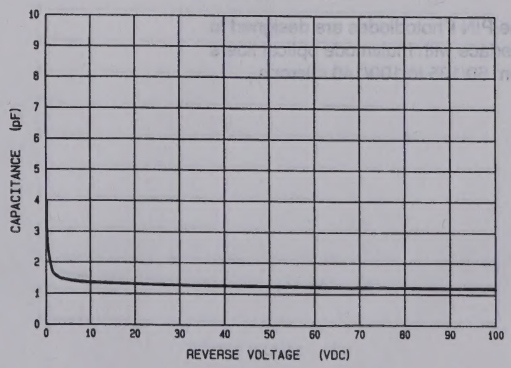

**Relative Spectral Response**




**DARK CURRENT vs. REVERSE VOLTAGE**

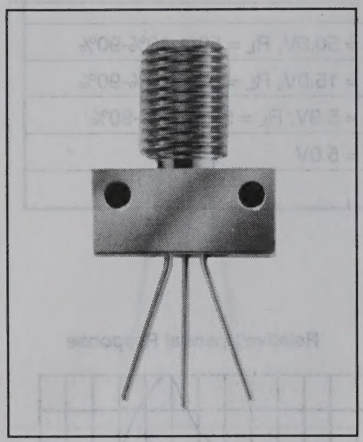


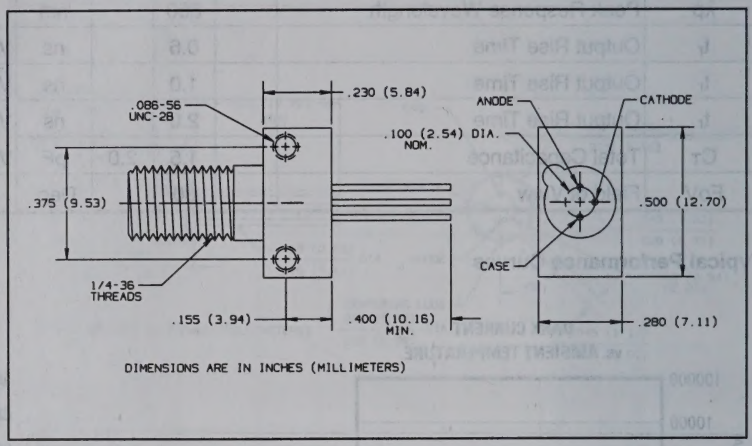

**Typical Capacitance vs Reverse Voltage**




FIBER OPTIC COMPONENTS

# Fiber Optic High Speed PIN Photodiode in SMA Receptacle
# Type OPF481






## Features

- Component pre-mounted and ready to use
- High speed, low capacitance
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- Electrically isolated from case

## Description

The OPF481 consists of a low cost plastic cap PIN photodiode pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -55°C to +100°C |
| Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.

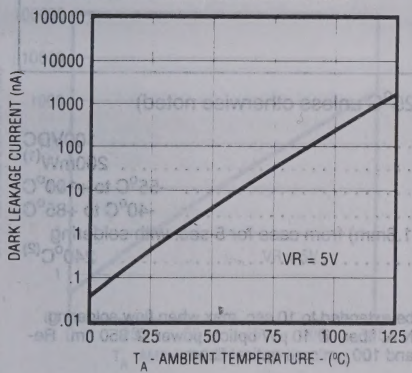
# Type OPF481

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

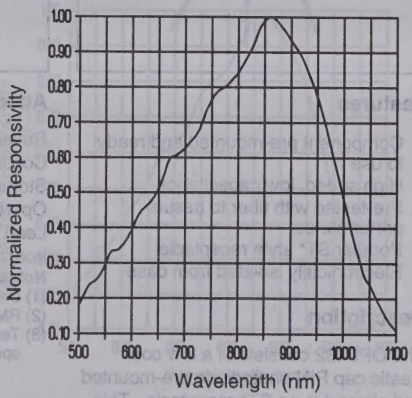
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0V(3) |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0V |
| λp | Peak Response Wavelength | | 860 | | nm | |
| $t_r$ | Output Rise Time | | 0.6 | | ns | $V_R$ = 50.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 1.0 | | ns | $V_R$ = 15.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 2.0 | | ns | $V_R$ = 5.0V, $R_L$ = 50Ω, 10%-90% |
| $C_T$ | Total Capacitance | | 1.5 | 2.0 | pF | $V_R$ = 5.0V |

## Typical Performance Curves

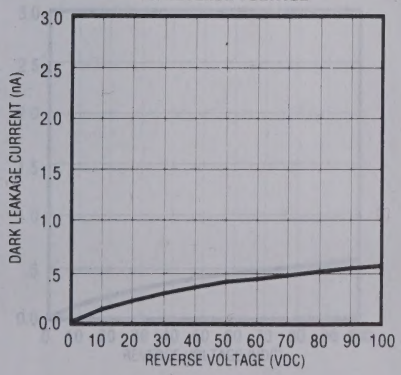
**DARK CURRENT vs. AMBIENT TEMPERATURE**



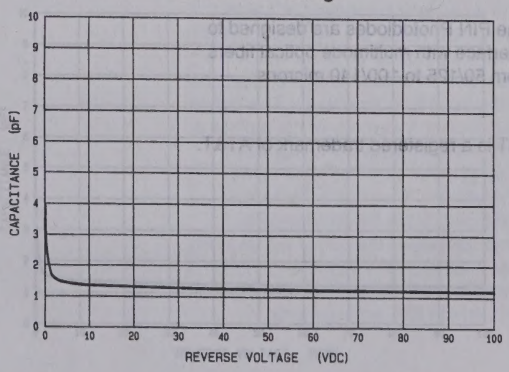

**Relative Spectral Response**




**DARK CURRENT vs. REVERSE VOLTAGE**



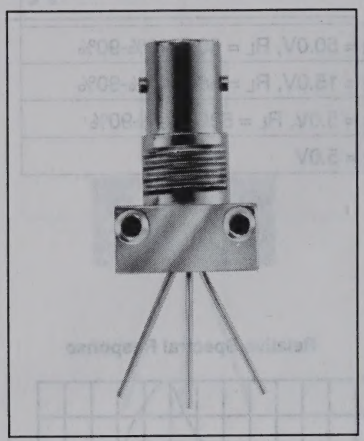

**Typical Capacitance vs Reverse Voltage**

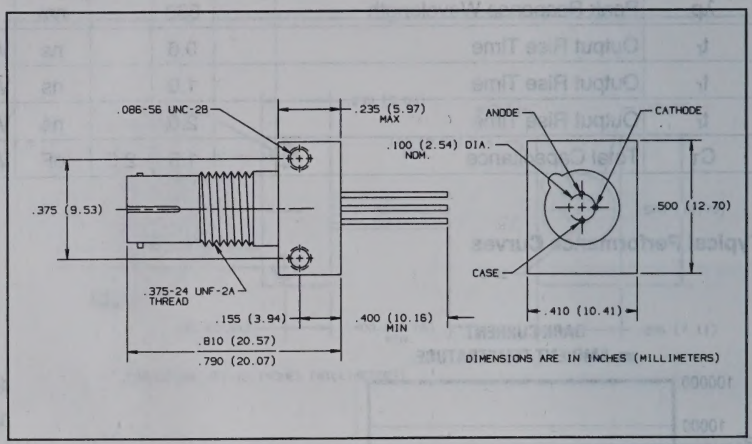



FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Fiber Optic High Speed PIN Photodiode in ST* Receptacle
## Type OPF482






### Features

- Component pre-mounted and ready to use
- High speed, low capacitance
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle
- Electronically isolated from case

### Description

The OPF482 consists of a low cost plastic cap PIN photodiode pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

*ST is a registered trademark of AT&T.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -55°C to +100°C |
| Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

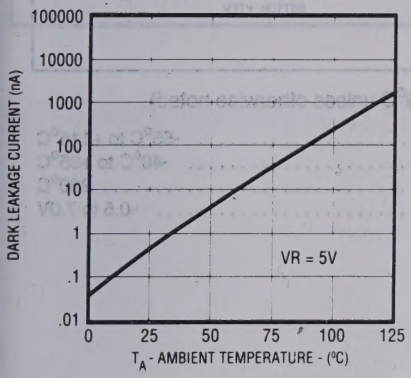
# Type OPF482

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

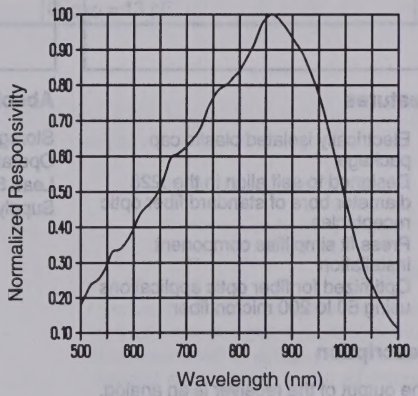
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R = 5.0V$[3] |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R = 5.0V$ |
| $\lambda p$ | Peak Response Wavelength | | 860 | | nm | |
| $t_r$ | Output Rise Time | | 0.6 | | ns | $V_R = 50.0V$, $R_L = 50\Omega$, 10%-90% |
| $t_r$ | Output Rise Time | | 1.0 | | ns | $V_R = 15.0V$, $R_L = 50\Omega$, 10%-90% |
| $t_r$ | Output Rise Time | | 2.0 | | ns | $V_R = 5.0V$, $R_L = 50\Omega$, 10%-90% |
| $C_T$ | Total Capacitance | | 1.5 | 2.0 | pF | $V_R = 5.0V$ |

## Typical Performance Curves

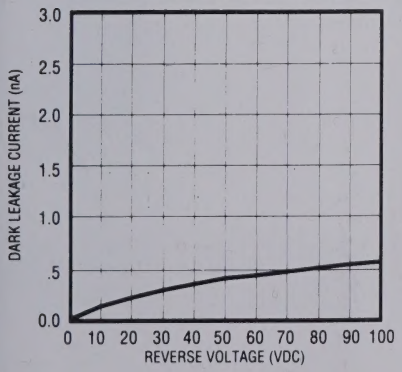
**DARK CURRENT vs. AMBIENT TEMPERATURE**



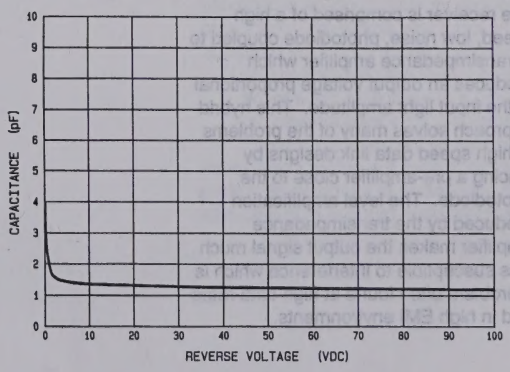

**Relative Spectral Response**




**DARK CURRENT vs. REVERSE VOLTAGE**

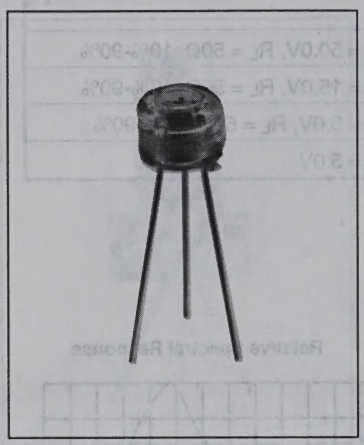


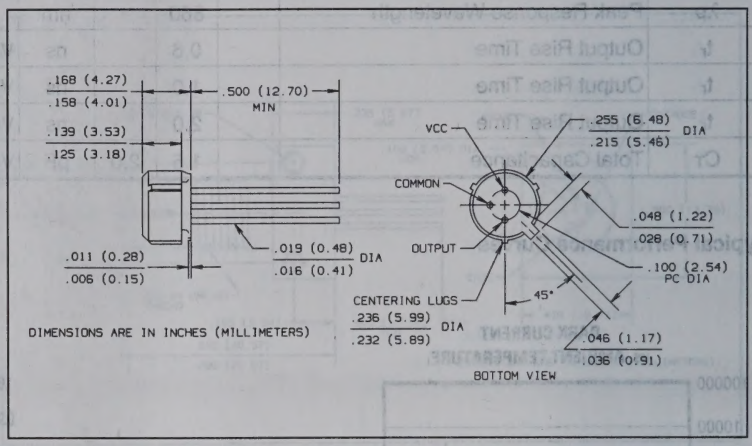

**Typical Capacitance vs Reverse Voltage**




FIBER OPTIC COMPONENTS

# 25 MHz Fiber Optic Receiver
## Type OPF540






### Features

- Electrically isolated plastic cap package
- Designed to self align in the .228 diameter bore of standard fiber optic receptacles
- Press fit simplifies component installation
- Optimized for fiber optic applications using 50 to 200 micron fiber

### Description

The output of the receiver is an analog, low impedance, voltage source capable of driving an amplifier or level translating circuitry for use on various data formats and data rates up to 35 MBaud.

The receiver is comprised of a high speed, low noise, photodiode coupled to a transimpedance amplifier which produces an output voltage proportional to the input light amplitude. This hybrid approach solves many of the problems of high speed data link designs by placing a pre-amplifier close to the photodiode. The level amplification produced by the transimpedance amplifier makes the output signal much less susceptible to interference which is a problem often found at high data rates and in high EMI environments.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature | -55°C to +115°C |
| Operating Temperature | -40°C to +85°C |
| Lead Soldering Temperature (for 10 sec.) | 260°C |
| Supply Voltage | -0.5 to 7.0V |

# Type OPF540

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

**$4.75 \le V_{CC} \le 5.25$, $R_{LOAD} = 511\ \Omega$, Fiber Sizes ≤ 100 Microns, N.A. ≤ 0.35**

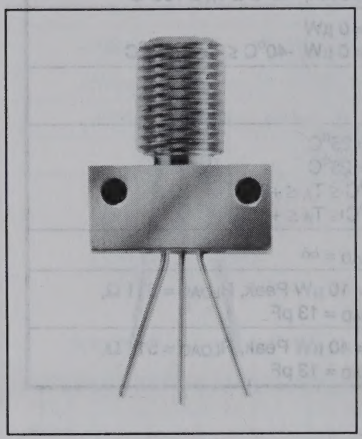
| SYMBOL | PARAMETERS | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $R_P$ | Responsivity | 6.5<br>5.8 | 9.3 | 12.5<br>14.1 | mV/μW<br>mV/μW | at 840 nm<br>at 840 nm, $-40^oC \le T_A \le +85^oC$ |
| $V_{NO}$ | RMS Output Noise Voltage | | 0.30 | 0.36<br>0.43 | mV<br>mV | $P_R = 0\ \mu W$<br>$P_R = 0\ \mu W$, $-40^oC \le T_A \le +85^oC$ |
| $P_N$ | Equivalent Optical Noise Input Power | | -44.9<br>0.032 | -40.9<br>0.082 | dBm<br>μW | |
| $P_R$ | Peak Input Power | | | -43.2<br>48<br>-44.7<br>34 | dBm<br>μW<br>dBm<br>μW | $T_A = 25^oC$<br>$T_A = 25^oC$<br>$-40^oC \le T_A \le +85^oC$<br>$-40^oC \le T_A \le +85^oC$ |
| $I_{CC}$ | Power Supply Current | | 3.4 | 6.0 | mA | $R_{LOAD} = \infty$ |
| $t_r$, $t_f$ | Rise Time, Fall Time (10% to 90%) | | 14 | 19.5 | ns | $P_R = 10\ \mu W$ Peak, $R_{LOAD} = 511\ \Omega$, $C_{LOAD} = 13$ pF |
| PWD | Pulse Width Distortion | | | 2 | ns | $P_R = 40\ \mu W$ Peak, $R_{LOAD} = 511\ \Omega$, $C_{LOAD} = 13$ pF |

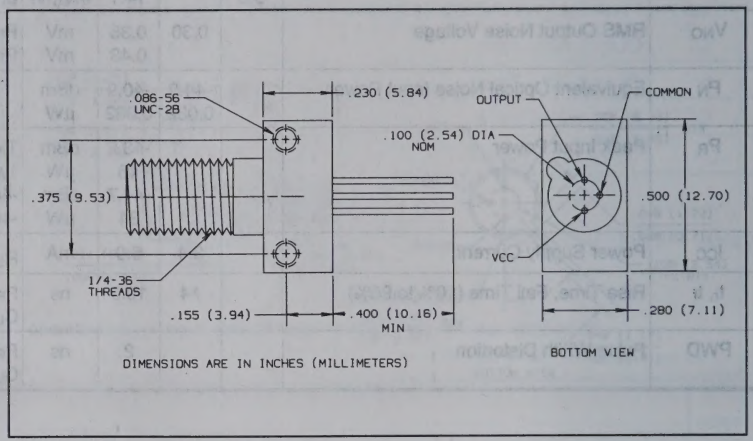


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# 25 MHz Fiber Optic Receiver
## Type OPF541






### Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle

### Description

The output of the receiver is an analog, low impedance, voltage source capable of driving an amplifier or level translating circuitry for use on various data formats and data rates up to 35 MBaud.

The receiver is comprised of a high speed, low noise, photodiode coupled to a transimpedance amplifier which produces an output voltage proportional to the input light amplitude. This hybrid approach solves many of the problems of high speed data link designs by placing a pre-amplifier close to the photodiode. The level amplification produced by the transimpedance amplifier makes the output signal much less susceptible to interference which is a problem often found at high data rates and in high EMI environments.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature | -55°C to +115°C |
| Operating Temperature | -40°C to +85°C |
| Lead Soldering Temperature (for 10 sec.) | 260°C |
| Supply Voltage | -0.5 to 7.0V |

# Type OPF541

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

**4.75 ≤ $V_{CC}$ ≤ 5.25, $R_{LOAD}$ = 511 Ω, Fiber Sizes ≤ 100 Microns, N.A. ≤ 0.35**

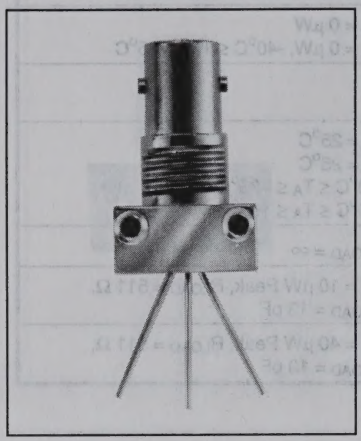
| SYMBOL | PARAMETERS | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $R_P$ | Responsivity | 6.5<br>5.8 | 9.3 | 12.5<br>14.1 | mV/μW<br>mV/μW | at 840 nm<br>at 840 nm, -40°C ≤ $T_A$ ≤ +85°C |
| $V_{NO}$ | RMS Output Noise Voltage | | 0.30 | 0.36<br>0.43 | mV<br>mV | $P_R$ = 0 μW<br>$P_R$ = 0 μW, -40°C ≤ $T_A$ ≤ +85°C |
| $P_N$ | Equivalent Optical Noise Input Power | | -44.9<br>0.032 | -40.9<br>0.082 | dBm<br>μW | |
| $P_R$ | Peak Input Power | | | -43.2<br>48<br>-44.7<br>34 | dBm<br>μW<br>dBm<br>μW | $T_A$ = 25°C<br>$T_A$ = 25°C<br>-40°C ≤ $T_A$ ≤ +85°C<br>-40°C ≤ $T_A$ ≤ +85°C |
| $I_{CC}$ | Power Supply Current | | 3.4 | 6.0 | mA | $R_{LOAD}$ = ∞ |
| $t_r$, $t_f$ | Rise Time, Fall Time (10% to 90%) | | 14 | 19.5 | ns | $P_R$ = 10 μW Peak, $R_{LOAD}$ = 511 Ω, $C_{LOAD}$ = 13 pF |
| PWD | Pulse Width Distortion | | | 2 | ns | $P_R$ = 40 μW Peak, $R_{LOAD}$ = 511 Ω, $C_{LOAD}$ = 13 pF |

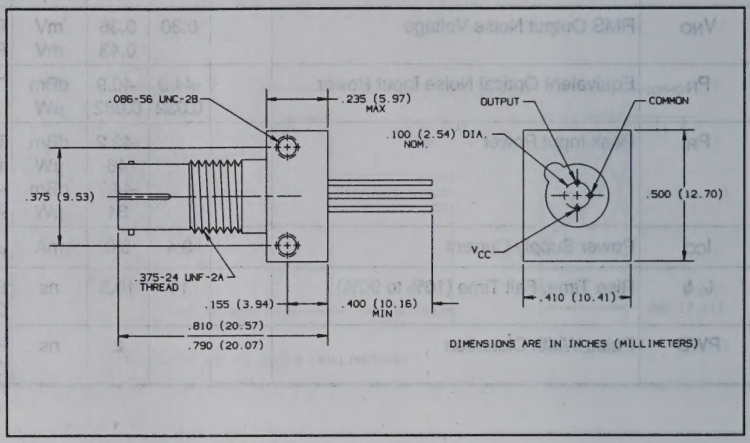


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# 25 MHz Fiber Optic Receiver
## Type OPF542






### Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular style receptacle

### Description

The output of the receiver is an analog, low impedance, voltage source capable of driving an amplifier or level translating circuitry for use on various data formats and data rates up to 35 MBaud.

The receiver is comprised of a high speed, low noise, photodiode coupled to a transimpedance amplifier which produces an output voltage proportional to the input light amplitude. This hybrid approach solves many of the problems of high speed data link designs by placing a pre-amplifier close to the photodiode. The level amplification produced by the transimpedance amplifier makes the output signal much less susceptible to interference which is a problem often found at high data rates and in high EMI environments.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature | -55°C to +115°C |
| Operating Temperature | -40°C to +85°C |
| Lead Soldering Temperature (for 10 sec.) | 260°C |
| Supply Voltage | -0.5 to 7.0V |

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Type OPF542

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

**4.75 ≤ $V_{CC}$ ≤ 5.25, $R_{LOAD}$ = 511 Ω, Fiber Sizes ≤ 100 Microns, N.A. ≤ 0.35**

| SYMBOL | PARAMETERS | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $R_P$ | Responsivity | 6.5<br>5.8 | 9.3 | 12.5<br>14.1 | mV/µW<br>mV/µW | at 840 nm<br>at 840 nm, -40°C ≤ $T_A$ ≤ +85°C |
| $V_{NO}$ | RMS Output Noise Voltage | | 0.30 | 0.36<br>0.43 | mV<br>mV | $P_R$ = 0 µW<br>$P_R$ = 0 µW, -40°C ≤ $T_A$ ≤ +85°C |
| $P_N$ | Equivalent Optical Noise Input Power | | -44.9<br>0.032 | -40.9<br>0.082 | dBm<br>µW | |
| $P_R$ | Peak Input Power | | | -43.2<br>48<br>-44.7<br>34 | dBm<br>µW<br>dBm<br>µW | $T_A$ = 25°C<br>$T_A$ = 25°C<br>-40°C ≤ $T_A$ ≤ +85°C<br>-40°C ≤ $T_A$ ≤ +85°C |
| $I_{CC}$ | Power Supply Current | | 3.4 | 6.0 | mA | $R_{LOAD}$ = ∞ |
| $t_r$, $t_f$ | Rise Time, Fall Time (10% to 90%) | | 14 | 19.5 | ns | $P_R$ = 10 µW Peak, $R_{LOAD}$ = 511 Ω, $C_{LOAD}$ = 13 pF |
| PWD | Pulse Width Distortion | | | 2 | ns | $P_R$ = 40 µW Peak, $R_{LOAD}$ = 511 Ω, $C_{LOAD}$ = 13 pF |

HYBRID ASSEMBLIES
The Opto Hybrid
FIBER OPTIC COMPONENTS

Product Bulletin OPF542
May 1993

# 25 Mbaud Fiber Optic Receiver Type OPF542

OPTEK TECHNOLOGY, INC.

# HYBRID ASSEMBLIES

## The Opto Hybrid

Hybrid Assemblies are a strategic product area for Optek Technology. This means Optek is dedicated to be the best at what we do and to service the needs of our customers.

Opto hybrids offer solutions to many applications that cannot be satisfied with standard or conventional components.

Hybrid technology offers significant advantages for many electronic applications. Size constraints and performance targets typically determine the choice of hybrid construction.

Optek's broad capabilities make it possible to address a diverse range of applications. Furthermore, our customers can specify and procure a total functional system package from a single, experienced source.

Our expertise includes:

**APPLICATION ENGINEERING**
**COMPUTER AIDED DESIGN**
**CUSTOM TEST SYSTEM DESIGN**
**CUSTOM SENSOR AND IC DEVELOPMENT**
**ENGINEERED PLASTICS AND INJECTION MOLDS**
**CHARACTERIZATION OF OPTOELECTRONIC PARTS**
**VERTICALLY INTEGRATED MANUFACTURING**



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# OPTO HYBRID FEATURES

Chip-on-board design provides several advantages:

**SIZE:** Used where the function cannot be accomplished with conventional through hole, leaded components. Space savings can be as much as 80% as compared with discrete packaged parts.

**PERFORMANCE:** Allows the designer to create functions that cannot be fabricated with separately made components. The vast majority of components are available in chip, SMD or thick film form. Laser trimming allows designs that require uniform characteristics over time and temperature and the entire population of assemblies.

**PACKAGING:** The opto hybrid offers unique shape and mounting configurations and material combinations to suit a special set of environmental conditions. The standard materials and processes result in packages that accommodate extended temperatures beyond the range of many commercial components.

**RELIABILITY:** Reduced part count, automated processes, and Optek's commitment to quality result in robust, defect free parts.

**COST:** Chip carriers withstand the challenges of low cost automated handling, placement, and reflow soldering. In comparison to a custom IC solution, the development cost of a typical hybrid circuit is far less and modifications are quicker and easier. Array processing in hybrid fabrication minimizes cost and optimizes quality.

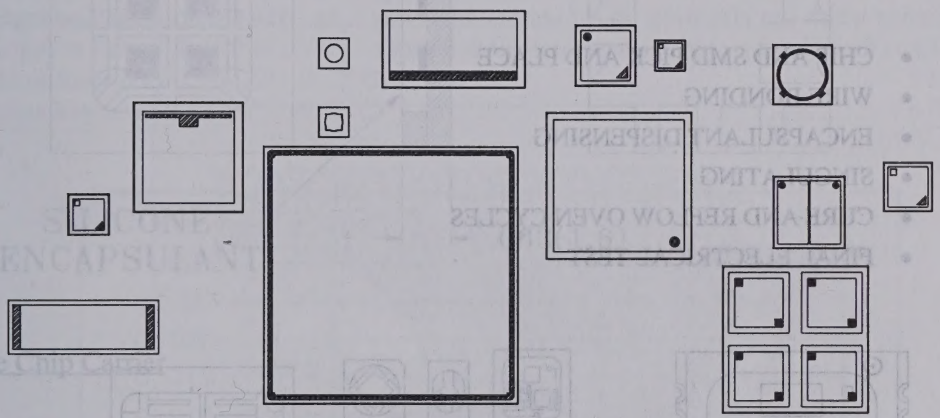
The flexibility to choose and combine the best technologies for your application is the feature that makes hybrid technology so valuable.

## CUSTOM CAPABILITIES

Standard PC board fabrication flexibility allows for various component orientations, mounting features, and interconnect schemes.

The starting substrates can be Epoxy-glass, Polyimide, Flex Circuits, or Ceramic. Production tooling is in place for a standard array format of 4" X 4", but custom tooling can be designed to meet the needs of other materials, sizes, and shapes.

Substrates, encapsulants, and plating can be tailored to meet the circuit requirements.



Even with the standard chip carrier materials and processes, imagination is the only limit to the possible configurations.

Design variables include:

- MATERIALS
- OPTICAL PROPERTIES
- LEADS, PINS, OR CABLES
- SPECIAL TESTS AND PROCESSING

# CUSTOM CAPABILITIES

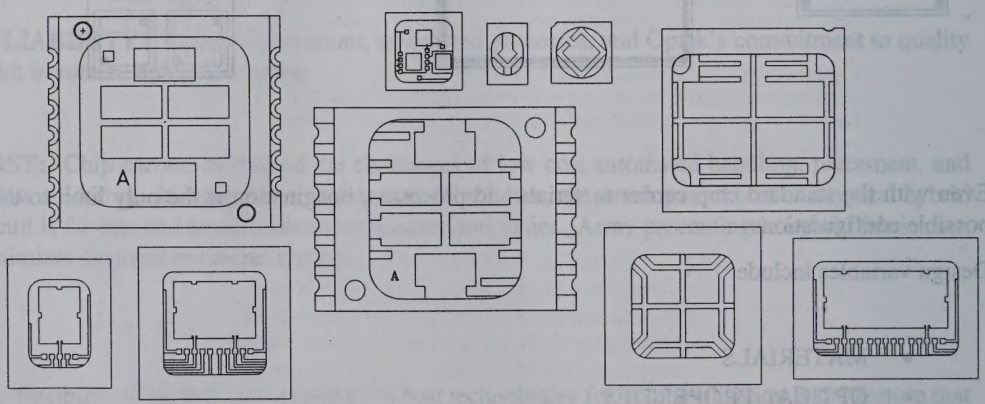
Optek produces a variety of IC's, Photosensors, and Light Emitting Diodes that can be incorporated in custom designs. Optek is not limited to the sensor applications which use optoelectronics. Starting at the chip level, we design, develop, and manufacture state-of-the-art Hall Effect and Power devices.

When standard devices are not a match, our internal design capability will satisfy the application circuit requirement.

Manufacturing flexibility makes the Hybrid facility effective for serving both the high complexity and high volume assembly needs.

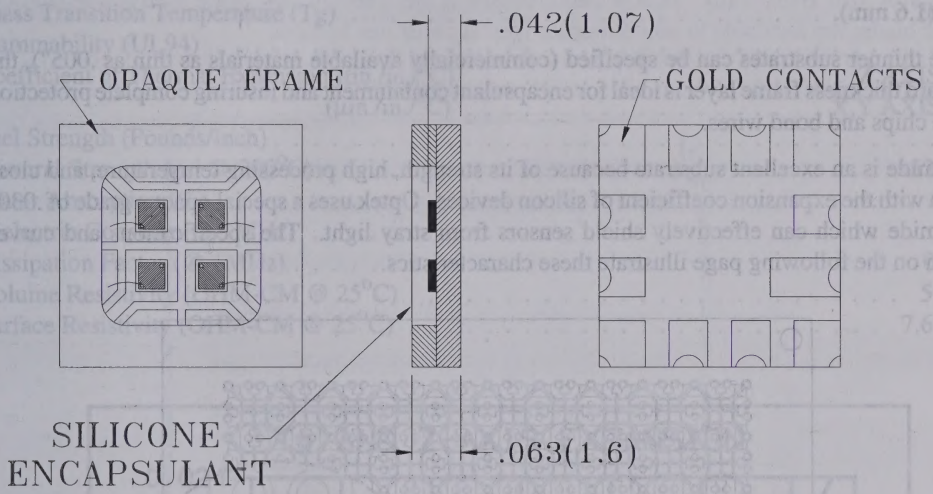
Computer controlled manufacturing operations include:

- CHIP AND SMD PICK AND PLACE
- WIRE BONDING
- ENCAPSULANT DISPENSING
- SINGULATING
- CURE AND REFLOW OVEN CYCLES
- FINAL ELECTRICAL TEST



# OPTEK TECHNOLOGY
# HYBRID CHIP CARRIER DESIGN RULES

The most cost effective chip-on-board products take advantage of standards in design and processing. The following guidelines for substrate layout are intended TO ASSIST the designer in the first stage of product development .




## The Chip Carrier

The polyimide chip carrier, an Optek Standard packaging method, has four main parts: substrate, frame, components, and encapsulation. The substrate is fabricated from high temperature copper-clad laminate. Standard pc board processing provides the plated and non-plated holes, circuit patterns, and chip mounting features. The frame layer is made from the same polyimide laminates.

To make the substrate compatible with die attach and wire bonding techniques, the copper surface is plated with a nickel barrier and gold. After the chip components are mounted and bonded, the frame is screen printed with a pattern of non-conductive epoxy, aligned with the matching substrate cells and laminated under elevated temperature and pressure.

A conformal coating is applied to fill the component cavities. After curing, the array is sawed into individual product elements and ready for test.



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

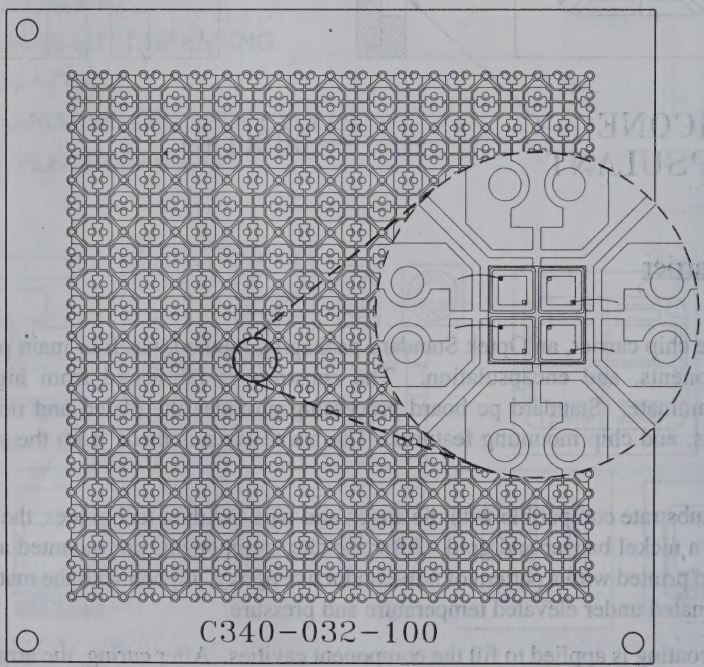
# HYBRID CHIP CARRIER DESIGN RULES

## The Substrate Material

The Optek standard chip carrier substrate and frame material thickness is .030"(0.76 mm). Including the adhesive and metal layers, this two layer, laminated package has a nominal thickness of .063"(1.6 mm).

While thinner substrates can be specified (commercially available materials as thin as .005"), the standard thickness frame layer is ideal for encapsulant containment and insuring complete protection of the chips and bond wires.

Polyimide is an excellent substrate because of its strength, high processing temperature, and close match with the expansion coefficient of silicon devices. Optek uses a special opaque grade of .030" polyimide which can effectively shield sensors from stray light. The specifications and curves shown on the following page illustrate these characteristics.

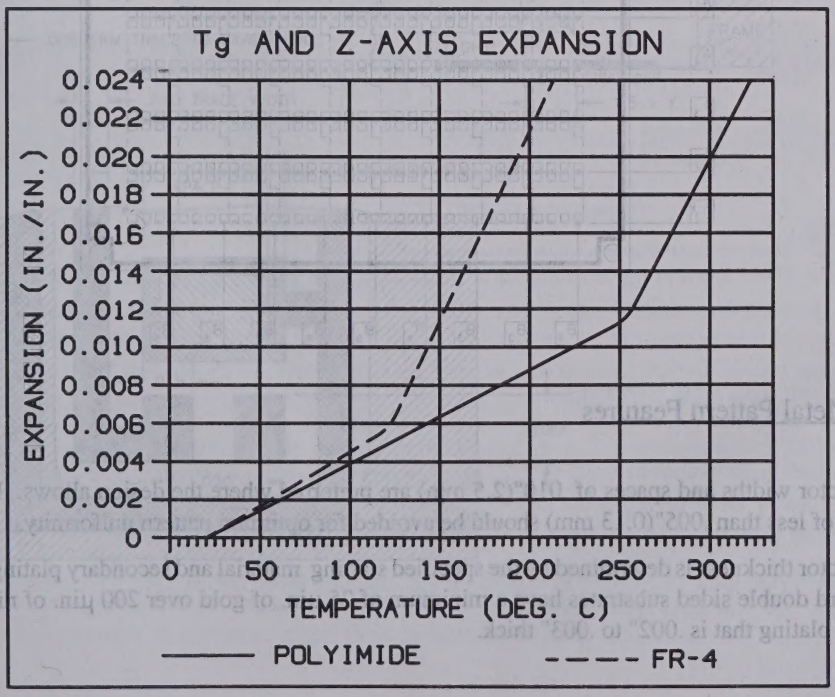



FR-4 and other high temperature epoxy-glass laminates are also suitable for the chip-on-board processing and may be recommended for certain applications.

# HYBRID CHIP CARRIER DESIGN RULES

## Polyimide Substrate Characteristics

| | |
|---|---|
| Operating Temperature (10K Hours) | 250°C |
| Glass Transition Temperature (Tg) | 260°C |
| Flammability (UL94) | V1 |
| Coefficient of Thermal Expansion(µin./in./°C) | Z AXIS=55 |
| (µin./in./°C) | X,Y AXIS=15 |
| Peel Strength (Pounds/Inch) | 8 |
| Flexural Strength (psi @ 200°C) | 52,000 |
| Water Absorption (%) | 0.32 |
| Dielectric Constant (@ 1MHz) | 4.3 |
| Dissipation Factor (@ 1MHz) | 0.015 |
| Volume Resistivity (OHM-CM @ 25°C) | 5 E15 |
| Surface Resistivity (OHM-CM @ 25°C) | 7.6 E13 |



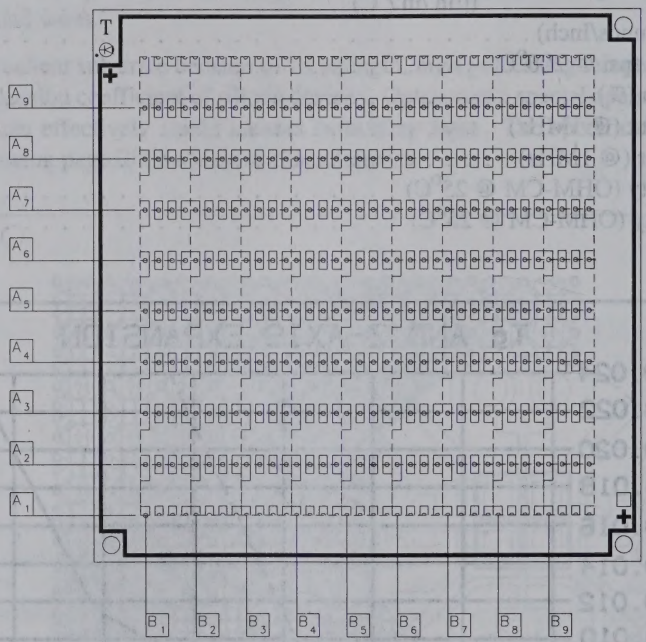

HYBRID ASSEMBLIES

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# HYBRID CHIP CARRIER DESIGN RULES

## The Substrate Layout

Minimizing the size of the final package maximizes the cost effectiveness of the array process. As shown in the figure below, improved packing density is possible on the 4" X 4" substrate when cells are arranged to share through hole connections. A "half hole" contact remains with each cell when the elements are cut into the individual parts. Individual cells are arranged with separations or borders of .015"(0.38 mm). This is the thickness of the standard saw blade used for separation. Wider blades are available to accommodate special perimeter features.




## The Metal Pattern Features

Conductor widths and spaces of .010"(2.5 mm) are preferred where the design allows. Lines and spaces of less than .005"(0.13 mm) should be avoided for optimum pattern uniformity.

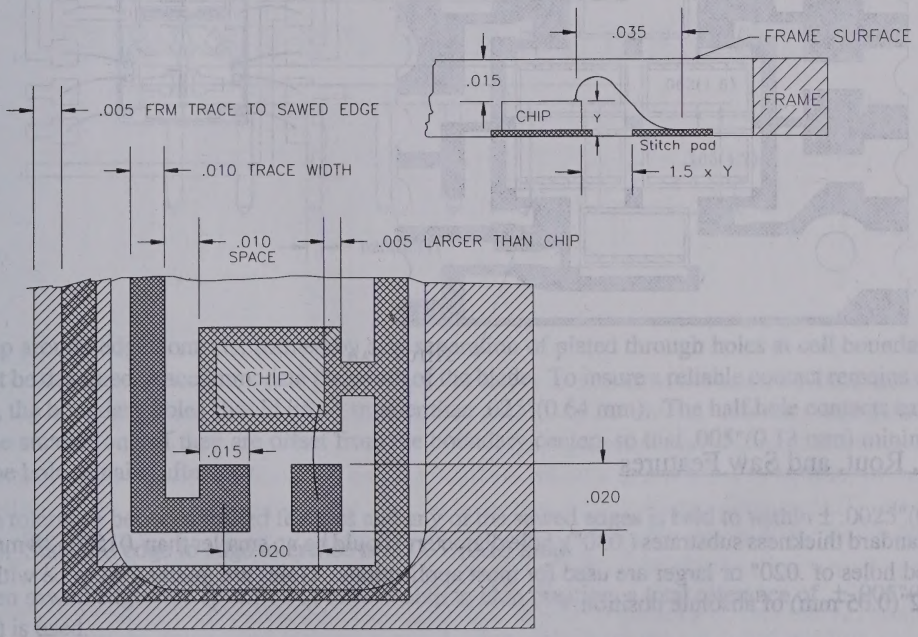
Conductor thickness is determined by the specified starting material and secondary plating process. Standard double sided substrates have a minimum of 25 µin. of gold over 200 µin. of nickel over copper plating that is .002" to .003" thick.

## Metal Pattern Features (Continued)

Alignment between the metal pattern and drilled or routed features is held to ±.002"(0.05 mm). Chip registration may be specified in relation to substrate holes or the sawed perimeter to eliminate the metal to hole pattern tolerance as a consideration.

The wire bonding stitch pads on the metal pattern are nominally .015" x .020"(0.38 mm x 0.5 mm) with the longer dimension aligned with the bond wire. Stitch pads of .007" x .015"(0.18 mm x 0.38 mm) are considered the minimum size.

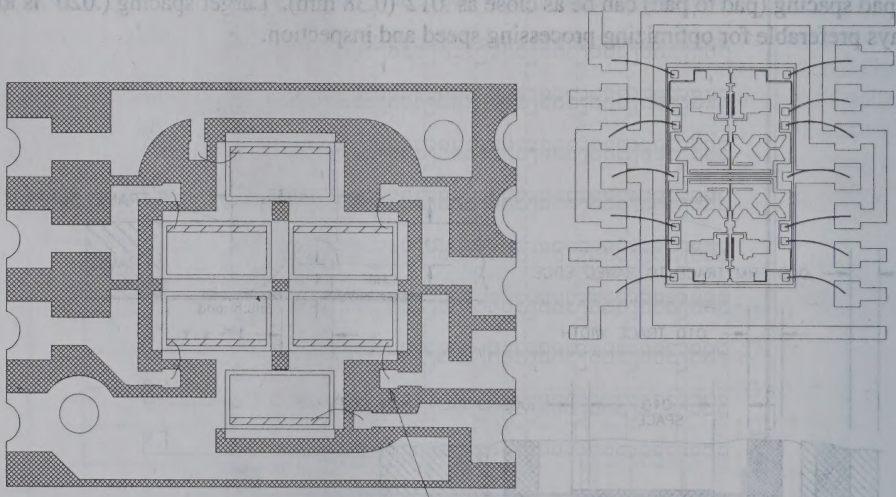
Stitch pad spacing (pad to pad) can be as close as .012"(0.38 mm). Larger spacing (.020" is ideal) is always preferable for optimizing processing speed and inspection.



# HYBRID CHIP CARRIER DESIGN RULES

## Metal Pattern Features (Continued)

Chip mounting pads are often sized to be at least .005" larger than small chips such as LEDs. Even larger pads may be desirable for increased power dissipation or to provide a greater light reflecting surface. The mounting pad can be as small as the die itself for larger components. The pad edges can then be used as chip alignment features. This is particularly useful for designs where the metal pattern establishes a datum.



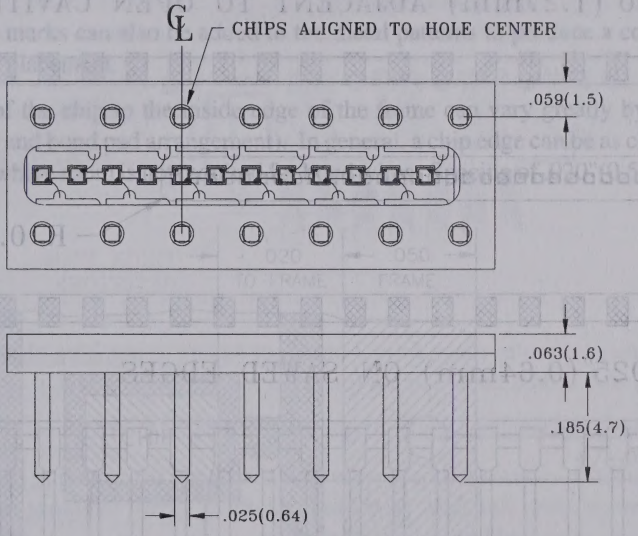

## Drill, Rout, and Saw Features

For standard thickness substrates (.030"), hole diameters should be no smaller than .015"(0.38 mm). Drilled holes of .020" or larger are used for most applications. Holes are guaranteed to be within ± .002"(0.05 mm) of absolute position.

When specifying .062"(1.57 mm) thickness for the substrate layer, the minimum recommended hole diameter is .030" to minimize cost.

## Drill, Rout, and Saw Features (Continued)

To make leaded parts, square pins can be pressed into substrate holes. Standard press fit terminals (.025" square) require enough substrate area for a .031"(0.8 mm) diameter plated through hole with a pad diameter of .062"(1.57 mm). Pin centers should be no closer than .050"(1.27 mm) to the perimeter of the part to avoid fracturing the laminate.




Wrap around edge contacts, formed by saw separation of plated through holes at cell boundaries, must be designed to accommodate the width of the blade. To insure a reliable contact remains after saw, the boundary holes should be no smaller than .025"(0.64 mm). The half hole contacts can be made smaller only if they are offset from the boundary centers so that .005"(0.13 mm) minimum of the hole remains after saw.

The tolerance between drilled features and any of the sawed edges is held to within ± .0025"(0.06 mm). Standard edge to edge tolerance is ± .005"(0.13 mm).

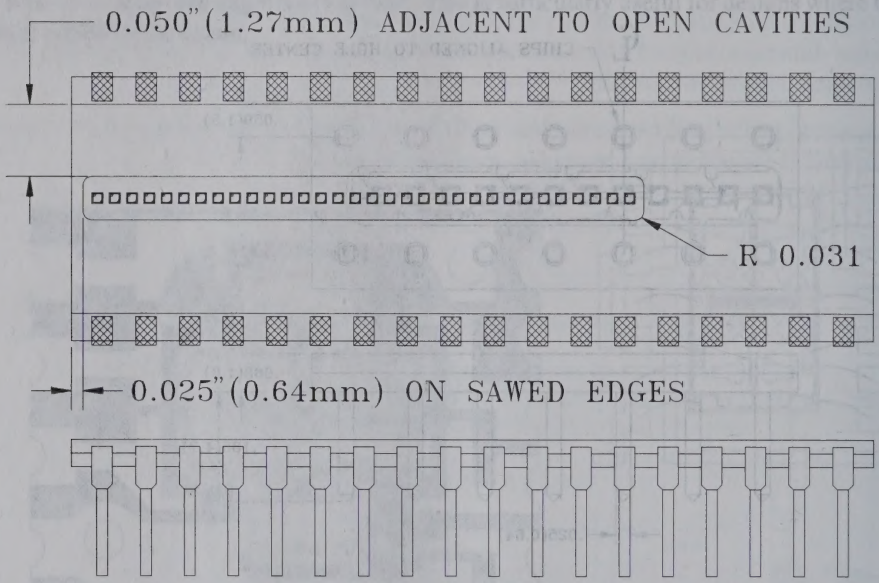
When sawed edges are specified in relationship to chip position, a total tolerance of ± .005"(0.13 mm) is used.

Wherever the design permits, metal patterns are typically recessed a minimum of .005"(0.13 mm) from these sawed edges to minimize metal flash or burrs between conductors.

# HYBRID CHIP CARRIER DESIGN RULES

## Frame Size and Shape

The size of the routed frame is often based on the need for including features for mounting or alignment with other components. Minimizing the size of a framed carrier depends on chip placement, the arrangement of wire bond patterns, and strength considerations.




The frame width (distance from the chip cavity to an outside edge) is recommended to be .050"(1.27 mm) when space allows. A wide frame insures maximum adhesion to the substrate and prevents low viscosity encapsulant from escaping the cavity. This is especially important for wall sections adjacent to unfilled cavities where a width of .040"(1.0 mm) should be considered the absolute minimum. Thinner walls are effective encapsulant barriers when adjacent cavities are also filled. Minimum wall width is also affected by the cavity size. Longer sections require wider walls for strength. Frame walls of .025"(0.64 mm) or wider are recommended.

The frame cavities can be a variety of shapes and sizes, but because they are formed by a routing operation, inside features are rounded. Chip placement must accommodate these radii which are nominally .031"(0.8 mm). The smallest radius which can be specified for standard processing is .020"(0.5 mm). Sharp inside corners can be fabricated with laser machining but at a significantly higher processing cost.

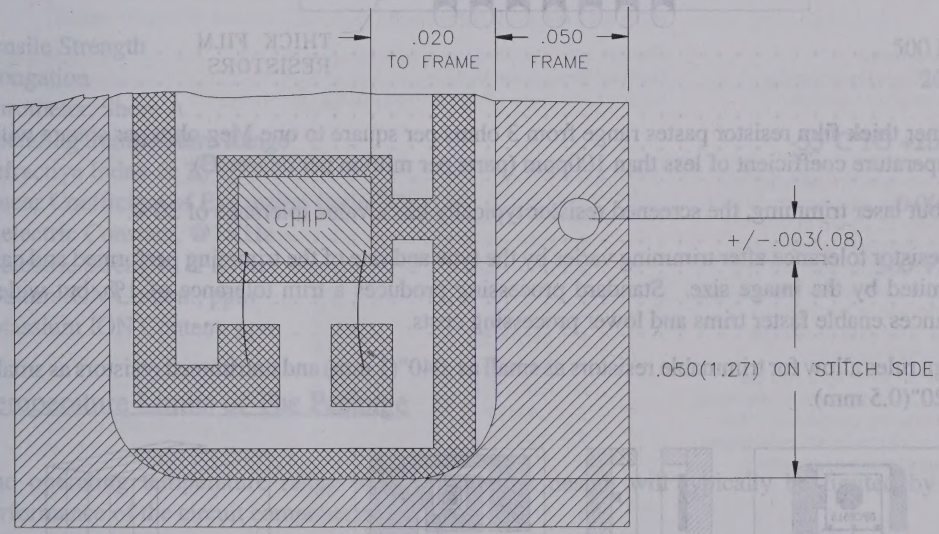
# HYBRID CHIP CARRIER DESIGN RULES

## Chip Placement and Wire Bonds

Chip position may be specified with relation to drilled holes, routed or sawed edges, or the circuit's metal pattern. Registering the chips (especially sensors and LEDs) to holes is typically done when these holes will be used for aligning the carrier to features of the next level assembly or other optical components such as aperture masks.

Precise alignment marks can also be added to the metal patterns to produce a common datum for the die and carrier placement.

The relationship of the chip to the inside edge of the frame can vary greatly by the components selected (chip size and bond pad arrangement). In general, a chip edge can be as close as .015"(0.38 mm) to the frame where room is not required for bond wires. Spacing of .020"(0.5 mm) is preferred.




To allow room on a wire bonded side, the design rules call for .050" (1.27 mm) between the frame and the chip if possible and .035"(0.9 mm) as an absolute minimum.

The position of the bond pads on the chip is an important factor. A distance of .035"(0.9 mm) from the ball bond to the stitch bond is recommended when calculating the stitch pad position and the spacing to the edge of the frame. This allows for .015"(0.38 mm) nominal distance between the frame and stitch.



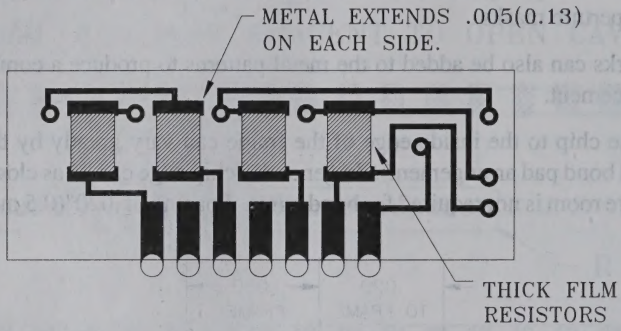
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# HYBRID CHIP CARRIER DESIGN RULES

## Screen Printed Materials

The alignment tolerance between the substrate and a screened image, such as solder mask, thick film resistors, or solder paste, is ± .005"(0.13 mm). Metal pattern features are made slightly larger than the screened image to include this tolerance.

Special processes can improve this tolerance to ± .003"(0.08 mm) for some materials and geometries.

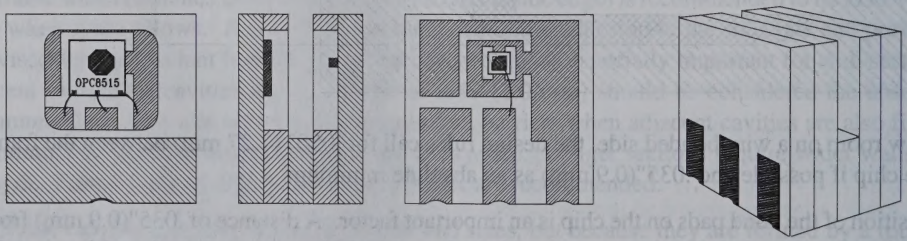



Polymer thick film resistor pastes range from 3 ohms per square to one Meg ohm per square with a temperature coefficient of less than 100ppm (parts per million per degree C).

Without laser trimming, the screened resistor typically has a value tolerance of 20%.

The resistor tolerance after trimming varies by the type and rate of the trimming performed and can be limited by the image size. Standard processing produces a trim tolerance of 1%, but wider tolerances enable faster trims and lower processing costs.

Design rules allow for trimmable resistors as small as .040"(1 mm) and untrimmed resistors as small as .020"(0.5 mm).




Discrete components may be placed on the back side of the substrate along with screened materials. Most surface mount parts can be placed automatically. Pad size and spacing for such components should follow manufacturer recommendations.

# HYBRID CHIP CARRIER DESIGN RULES

## Encapsulation

The standard chip carrier construction is compatible with a wide variety of encapsulation materials, viscosities, and cure cycles because the framed cavities are completely enclosed and deep enough for any chip and bond wire profile.

Silicone is used as the standard encapsulant because of its wide operating temperature range, excellent adhesion, and ease of processing. It is ideal for optoelectronic applications because of its clarity and resistance to abrasion in subsequent cleaning operations.

Other encapsulants may be indicated where specific mechanical or chemical environments are not compatible with silicone. The material or its characteristics may be specified for new products.

The specifications for Optek's standard silicone are shown below.

Silicone Characteristics

| | |
|---|---|
| Tensile Strength | 500 PSI |
| Elongation | 200% |
| Durometer, Shore A | 30 |
| Operating Temperature Range | -55°C TO +200°C |
| Refractive Index @ 25°C | 1.43 |
| Linear Coefficient of Expansion (in/in/°C) | 0.00021 |
| Dielectric Constant, @1KHz | 3.0 |
| Dielectric Strength, @1KHz | 500 V/mil |
| Sodium ION Content, ppm | 2 |
| Potassium ION Content, ppm | 4 |

## Temperature Limits of The Package

The operating temperature range of any particular design will typically be limited by the performance of the circuit components.

Special encapsulants and other attached components such as molded plastic lenses or housings must also be considered in both the operating and processing temperature of the chip carrier.

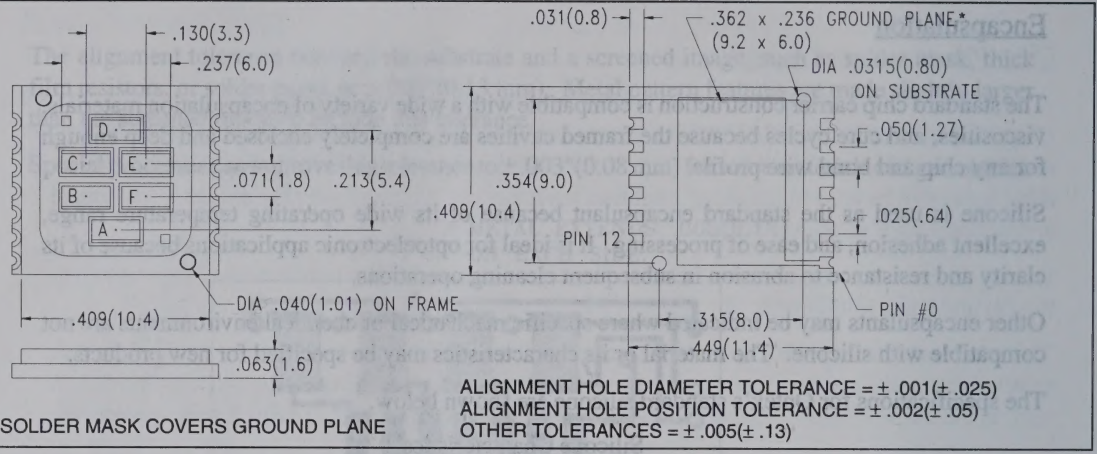
The standard silicone encapsulated polyimide package can withstand an environment of -55°C to +150°C indefinitely.

Reflow soldering of the surface mount packages can be performed with infrared, vapor phase, convection, or wave solder methods. The recommended limit for vapor phase reflow (up to 235°C) is 30 seconds.



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Six Element SMD Photodiode Array
## Type OPR2100




### Features

- Surface Mountable
- Closely Matched Responsivity
- High Temperature Operation

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

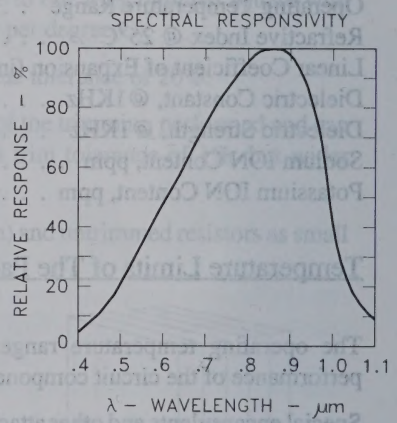
| | |
|---|---|
| Storage and Operating Temperature | -55°C to +125°C |
| Reverse Breakdown Voltage | 50V MIN. |
| Solder Temperature (Vapor Phase Reflow for 30 sec.) | 235°C |

### Description

Enclosed in a compact polyimide chip carrier, this six element photodiode has been specifically designed to meet the needs of motor encoder applications. Six individual chips are mounted on isolated cathode contacts to allow external connection in any desired configuration. The custom opaque package material shields the photodiodes from stray light and can withstand multiple exposures to the most demanding soldering conditions. The wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

### PIN OUT:

| | |
|---|---|
| PIN #0. | GROUND PLANE |
| 1. | CATHODE A |
| 2. | CATHODE B |
| 3. | ANODE B |
| 4. | ANODE C |
| 5. | CATHODE C |
| 6. | CATHODE D |
| 7. | ANODE D |
| 8. | CATHODE E |
| 9. | ANODE E |
| 10. | ANODE F |
| 11. | CATHODE F |
| 12. | ANODE A |

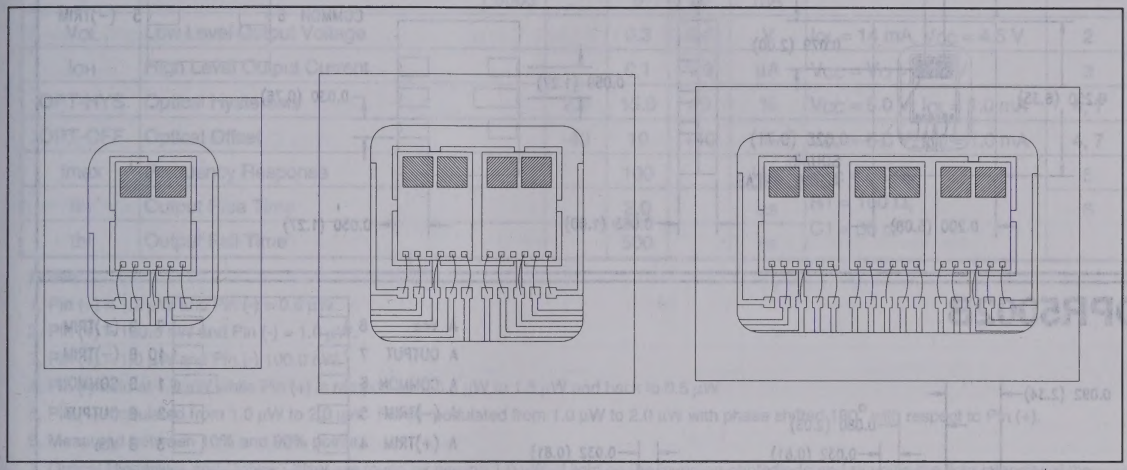



### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETERS | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $R_\lambda$ | Responsivity | .45 | | | A/W | $\Phi_e$= 10 μW, λ = 890 nm, V = 0 |
| $V_{(BR)R}$ | Reverse Breakdown Voltage | 50 | | | V | $I_R$ = 100 μA |
| $I_D$ | Reverse Dark Current | | | 10 | nA | $V_R$ = 10 V |
| $C_T$ | Capacitance | | 10 | | pf | $V_R$ = 10 V |
| L x W | Active Area (per diode) | | 2.9 | | $mm^2$ | (1.1 mm x 2.6 mm) |

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Optical Comparator Arrays
## Type OPR5001B, OPR5002B, OPR5003B



### Features

- Surface mountable
- Multiple channels available
- TTL compatible output
- Wide supply voltage range

### Description

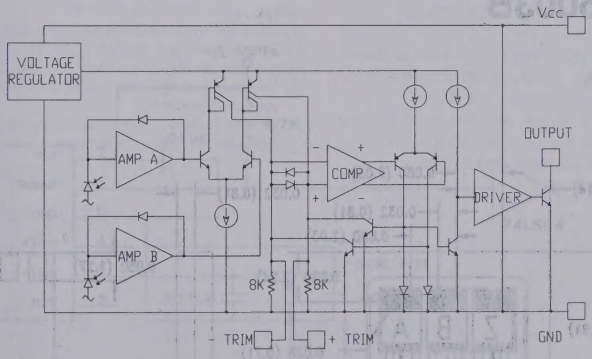
The OPR5001B, OPR5002B and OPR5003B are hybrid sensor arrays consisting of one, two or three channels of the Optek OPC8032 Differential Optical Comparator, ("DOC") IC. Specifically designed for encoder applications, the open collector output switches based on the comparison of input photodiode's light current levels. Logarithmic amplification of the input signals makes possible operation over a wide range of light levels.

The packages are surface mountable and made from a custom opaque polyimide which shields the active devices from stray light. The high temperature laminate can withstand multiple exposures to the most demanding soldering conditions. Wrap around contacts are gold plated for exceptional storage and wetting characteristics.

Replaces OPR5001A Series.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature | -55°C to +125°C |
| Operating temperature | -20°C to +80°C |
| Supply Voltage | 24V |
| Output Voltage | 24V |
| Output Current | 14mA |
| Power Dissipation | 500mW |
| Soldering Temperature (Vapor Phase Reflow for 30 sec.) | 235°C |



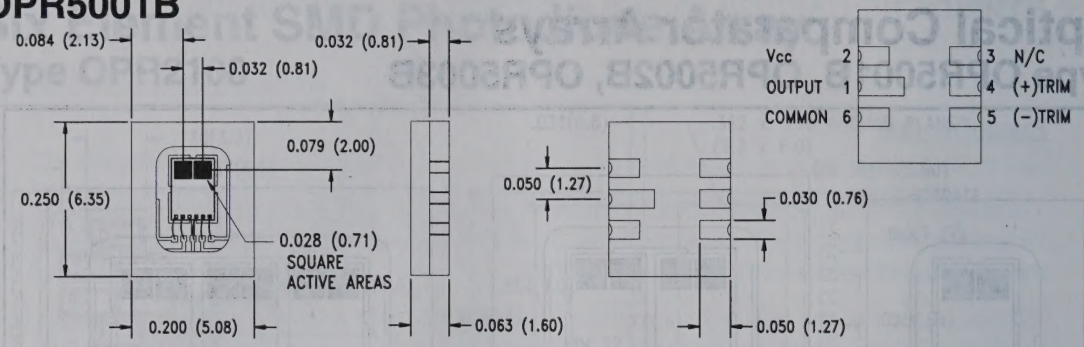

**OPC8032 Block Diagram**

HYBRID ASSEMBLIES

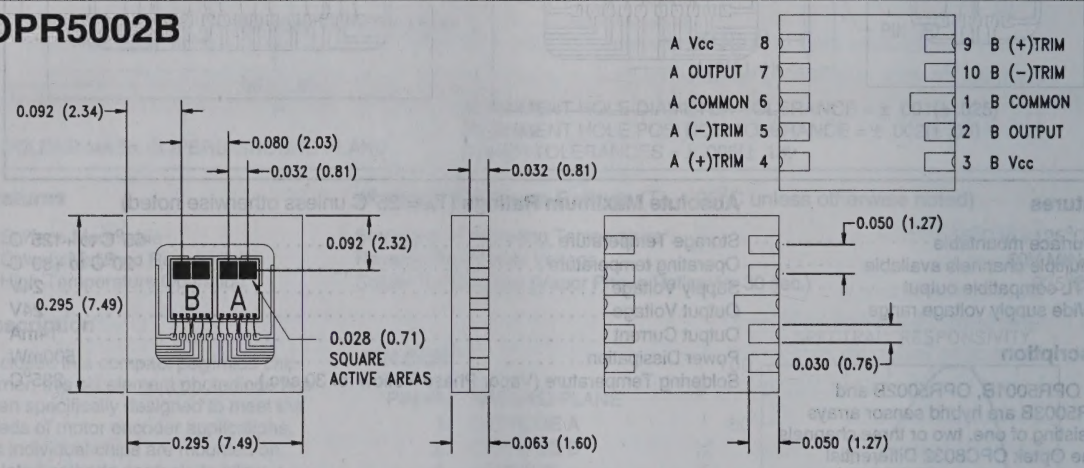
# Type OPR5001B, OPR5002B, OPR5003B

**Tolerance = ± .005(± .13) unless otherwise noted.**

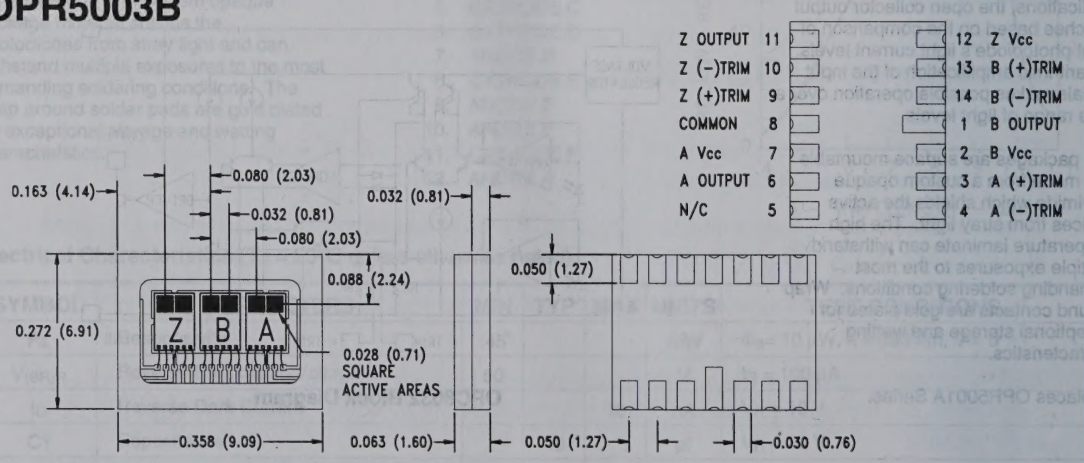
## OPR5001B




## OPR5002B




## OPR5003B



# Type OPR5001B, OPR5002B, OPR5003B

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS | NOTES |
|---|---|---|---|---|---|---|---|---|
| $I_{CC}$ | Supply Current | 5001 | | 3 | 7 | mA | $V_{CC}$ = 24 V | 1 |
| | | 5002 | | 6 | 14 | mA | | |
| | | 5003 | | 9 | 20 | mA | | |
| $V_{OL}$ | Low Level Output Voltage | | | 0.3 | 0.4 | V | $I_{OL}$ = 14 mA, $V_{CC}$ = 4.5 V | 2 |
| $I_{OH}$ | High Level Output Current | | | 0.1 | 1.0 | µA | $V_{CC}$ = $V_O$ = 20.0 V | 3 |
| OPT-HYS | Optical Hysteresis | | 2.0 | 15.0 | 40 | % | $V_{CC}$ = 5.0 V, $I_{OL}$ = 1.0 mA | 4, 7 |
| OPT-OFF | Optical Offset | | -40 | 10 | +40 | % | $V_{CC}$ = 5.0 V, $I_{OL}$ = 1.0 mA | 4, 7 |
| fmax | Frequency Response | | | 100 | | kHz | $V_{CC}$ = 5.0 V, | 5 |
| tlh | Output Rise Time | | | 2.0 | | µs | R1 = 100 Ω, | 6 |
| thl | Output Fall Time | | | 500 | | ns | C1 = 50 pf | |

**Notes:**

1. Pin (+) = 1.2 µW and Pin (-) = 0.8 µW.
2. Pin (+) = 100.0 nW and Pin (-) = 1.0 µW.
3. Pin (+) = 1.0 µW and Pin (-) 100.0 nW.
4. Pin (-) held at 1.0 µW while Pin (+) is ramped from 0.5 µW to 1.5 µW and back to 0.5 µW.
5. Pin (+) modulated from 1.0 µW to 2.0 µW. Pin (-) modulated from 1.0 µW to 2.0 µW with phase shifted 180° with respect to Pin (+).
6. Measured between 10% and 90% points.
7. Optical Hysteresis and Optical Offset are found by placing 1.0 µW of light on the inverting photodiode and ramping the light intensity of the noninverting input from .5 µW up to 1.5 µW and back down. This will produce two trigger points, an upper trigger point and lower trigger point. These points are used to calculate the optical hysteresis and offset.

These are defined as:

$$\% \text{ Optical Hysteresis} = 100 \times \frac{(P \text{ rise} - P \text{ fall})}{P \text{ in } (-)}$$

$$\% \text{ Optical Offset} = 100 \times \frac{(P \text{ average} - P (-))}{P \text{ in } (-)}$$

Where:

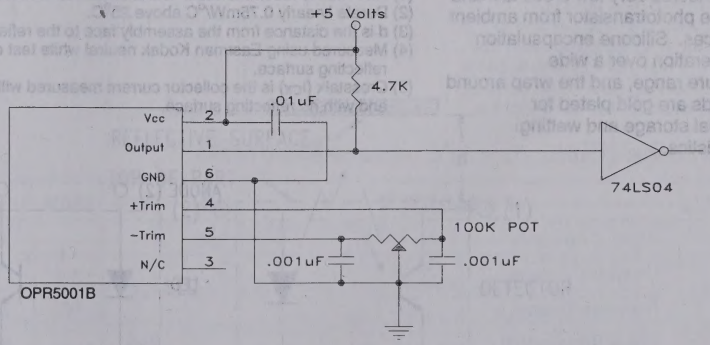
P in (-) = Light level incident upon the "-" photodiode on the I.C. chip (Pin (-) = 1.0 µW).

P rise = Value of light power level incident upon the "+" photodiode that is required to switch the digital output when the light level is an increasing level (rising edge).

P fall = Value of light power level incident upon the "+" photodiode that is required to switch the digital output when the light level is a decreasing level (falling edge).

$$P \text{ average} = \frac{(P \text{ rise} + P \text{ fall})}{2}$$

## Application Circuit



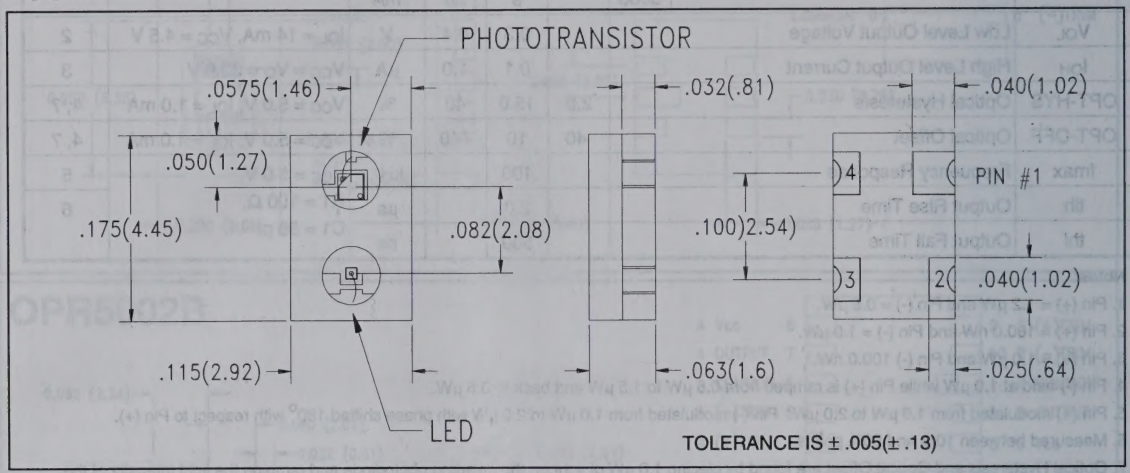

**Notes:**

1. A capacitance of a value between .001 to .01 µF connected as close as possible to the trim terminals is recommended if the device appears to be susceptable to noise transients. It is left to the user to determine the best value for the application.
2. The 74LS04 is recommended as a means of isolating the "DOC" comparator circuitry from transients induced by inductive and capacitive loads.
3. It is recommeded that a decoupling capacitor be placed as close as possible to the device.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# SMD Reflective Sensor
## Type OPR5005




### Features

- Surface mountable
- High temperature operation
- Compact size

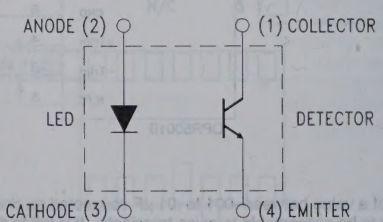
### Description

This miniature sensor combines a silicon phototransistor with a GaAlAs LED in a high temperature opaque polyimide chip carrier. It is designed to sense the motion or proximity of diffuse reflective surfaces in applications where space constraints preclude the use of larger leaded components. The opaque package insures very low cross talk and shields the phototransistor from ambient light sources. Silicone encapsulation allows operation over a wide temperature range, and the wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -55°C to +125°C |
| Soldering Temperature (Vapor Phase Reflow for 10 sec.) | 235°C |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 1.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 75mW(2) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 25mA |
| Power Dissipation | 75mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 30 sec. max when flow soldering.
(2) Derate linearly 0.75mW/°C above 25°C.
(3) d is the distance from the assembly face to the reflective surface.
(4) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Crosstalk ($I_{CX}$) is the collector current measured with the indicated current in the input diode and with no reflecting surface.



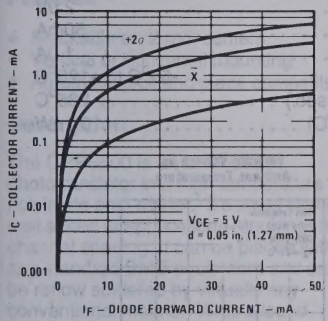
# Type OPR5005

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

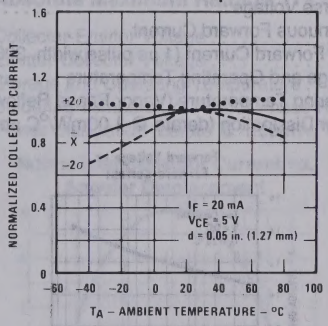
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0 V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | | V | $I_C$ = 100 µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | | V | $I_E$ = 100 µA |
| $I_{CEO}$ | Collector Dark Current | | | 100 | nA | $V_{CE}$ = 5.0 V, $I_F$ = 0, $E_e$ = ≤ 0.10 µW/cm$^2$ |
| **Combined** | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 100 | | | µA | $V_{CE}$ = 5.0 V, $I_F$ = 20 mA, d = 0.050 in. (1.27 mm)(3)(4) |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 0.40 | V | $I_F$ = 20 mA, $I_C$ = 100 µA, d = 0.050 in. (1.27 mm)(3)(4) |

## Typical Performance Curves

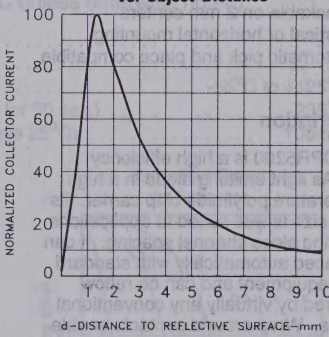
**Collector Current vs. Diode Forward Current**



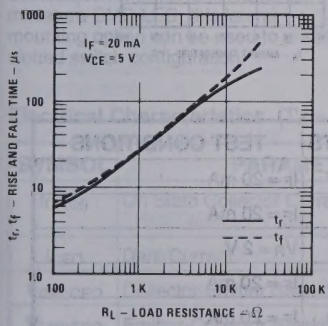

**Normalized Collector Current vs. Ambient Temperature**

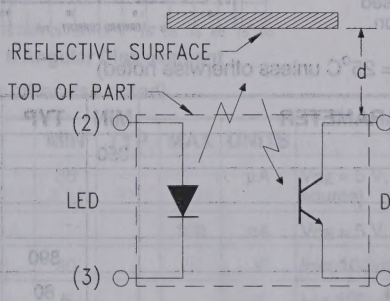



**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**

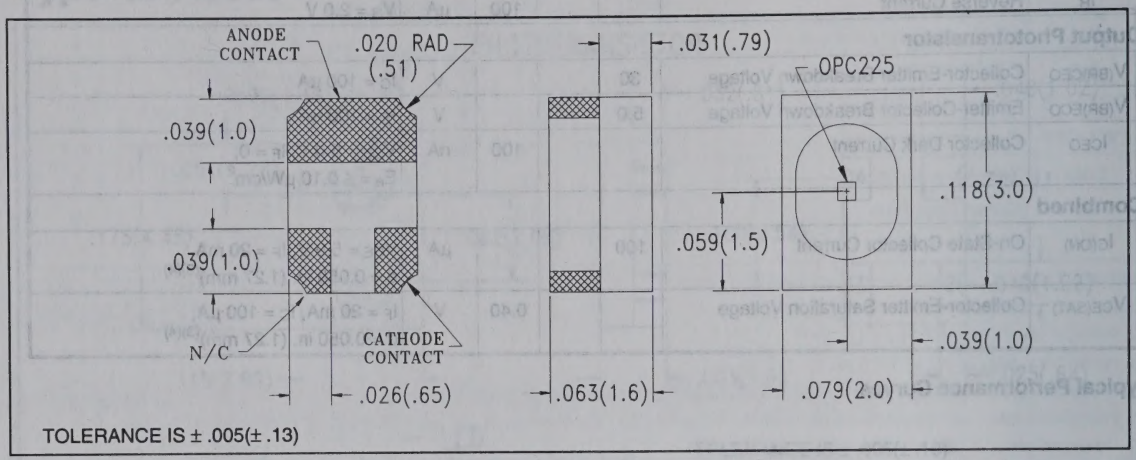



HYBRID ASSEMBLIES

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Miniature Surface Mount LED
## OPR5200




### Features

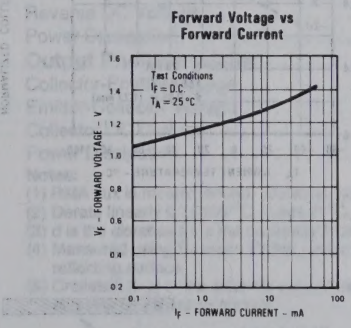
- Stackable on 2 mm centers
- Vertical or horizontal mounting
- Automatic pick and place compatible

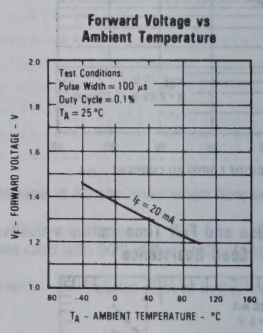
### Description

The OPR5200 is a high efficiency GaAlAs light emitting diode in a high temperature polyimide chip carrier. Its small size is well suited to applications requiring close channel spacing. It can be placed automatically with standard SMD equipment and can be reflow soldered by virtually any conventional means. Wrap around contacts enable the part to be mounted face up or on edge for a beam direction parallel to the seating plane. In combination with the OPR5500, the miniature phototransistor, this lateral mounting option can be used to create a slotted switch configuration.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 1.0A |
| Storage and Operating Temperature | -55°C to +125°C |
| Soldering Temperature (Vapor Phase Reflow for 30 sec.) | 235°C |
| Power Dissipation (derate @ 1.00mW/°C above 25°C) | 100mW |



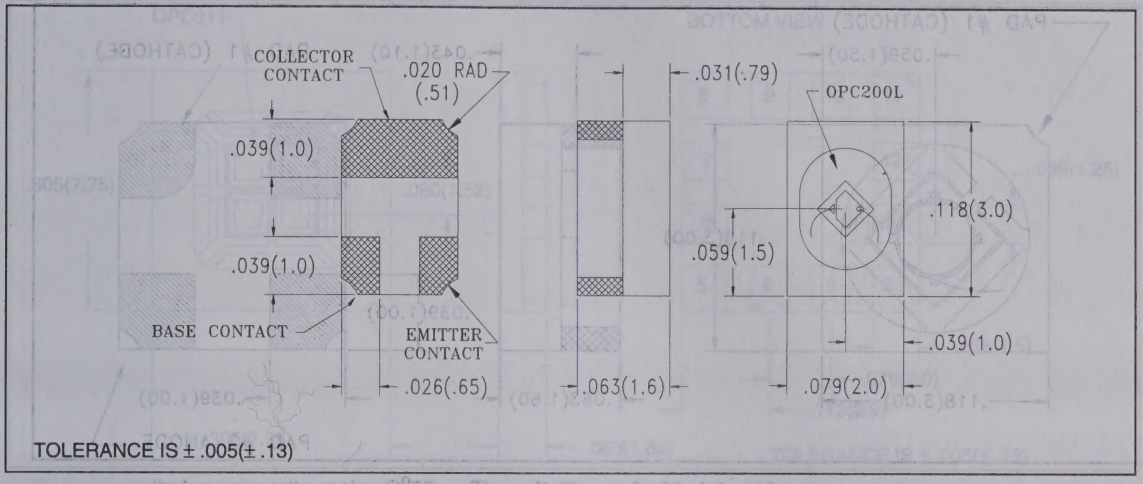


Forward Voltage vs Ambient Temperature
Test Conditions:
Pulse Width = 100 µs
Duty Cycle = 0.1%
$T_A$ = 25 °C
$I_F$ = 20 mA
$V_F$ - FORWARD VOLTAGE - V
$T_A$ - AMBIENT TEMPERATURE - °C

### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $P_O$ | Output Power | 350 | | | µW | $I_F$ = 20 mA |
| $V_F$ | Forward Voltage | | | 1.8 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2 V |
| $\lambda_p$ | Peak Wavelength | | 890 | | nm | $I_F$ = 20 mA |
| $\lambda_{BW}$ | Spectral Bandwidth | | 80 | | nm | $I_F$ = 20 mA |
| $\theta_{HP}$ | Emission Angle | | ± 45° | | | at half power points |
| $t_r$ | Output Rise Time | | 500 | | ns | $I_p$ = 100 mA<br>$P_W$ = 10.0 µs, D.C. = 10% |
| $t_f$ | Output Fall Time | | 250 | | ns | |

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Surface Mount Phototransistor
## OPR5500




### Features

- Stackable on 2 mm centers
- Vertical or horizontal mounting
- Automatic pick and place compatible

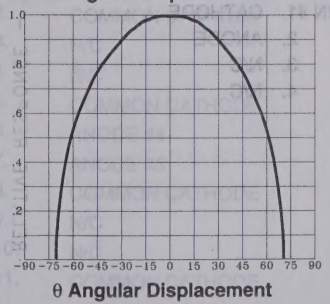
### Description

The OPR5500 is an NPN silicon phototransistor in a high temperature polyimide chip carrier. It's small size is well suited to applications requiring close channel spacing. It can be placed with any standard SMD equipment and can be reflow soldered by virtually any conventional means. Wrap around contacts enable the part to be mounted face up or on edge for beam detection parallel to the seating plane. In combination with the OPR5200, the miniature SMD LED, this lateral mounting option can be used to create a slotted switch configuration.

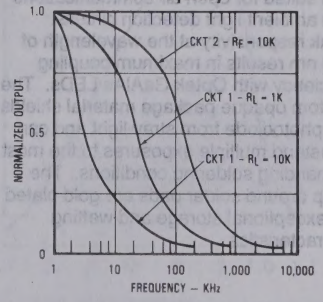
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5V |
| Storage and Operating Temperature | -55°C to +125°C |
| Soldering Temperature (Vapor Phase Reflow for 30 sec.) | 235°C |
| Power Dissipation (derate @ 1.00mW/°C above 25°C) | 100mW |

**Normalized Collector Current vs. Angular Displacement**




**Normalized Output vs. Frequency**

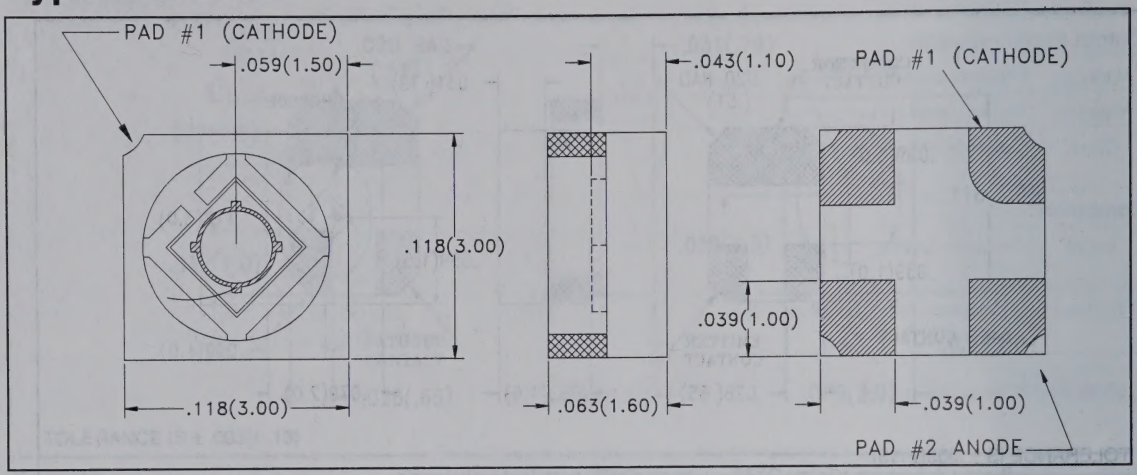



### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $I_{C(ON)}$ | On State Collector Current | 36 | | | µA | $V_{CE}$ = 5 V, $E_e$ = 150 µW/cm² (890 nm light source) |
| $I_{CEO}$ | Dark Current | | | 100 | nA | $V_{CE}$ = 5 V, $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | | V | $I_C$ = 100 µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5 | | | V | $I_e$ = 100 µA |
| $V_{CE(SAT)}$ | Saturation Voltage | | | 0.4 | V | $I_C$ = 100 µA, $E_e$ = 5 mW/cm² |
| $t_r$, $t_f$ | Rise Time, Fall Time | | 2.5 | | µs | $V_{CC}$ = 5 V, $I_C$ = 800 µA, R = 100 Ω |

HYBRID ASSEMBLIES

# Surface Mount Silicon PIN Photodiode
## Type OPR5910




### Features

- Surface Mountable
- Circular Active Area
- High Temperature Operation

### Description

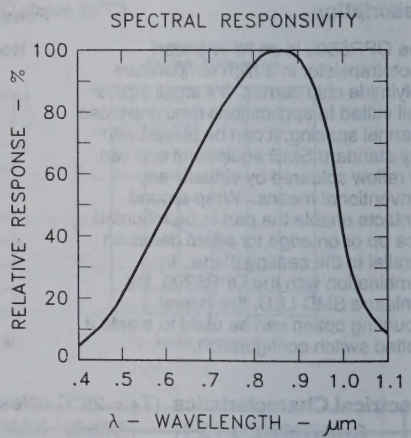
Enclosed in a compact polyimide chip carrier, this circular PIN photodiode is well suited for open air communications and ambient light detection circuits. Peak responsivity at the wavelength of 880 nm results in maximum coupling efficiency with Optek GaAlAs LEDs. The custom opaque package material shields the photodiode from stray light and can withstand multiple exposures to the most demanding soldering conditions. The wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature ..... -55°C to +125°C
Reverse Breakdown Voltage ..... 35V MIN.
Solder Temperature (Vapor Phase Reflow for 30 sec.) ..... 235°C

### PIN OUT:

PIN #1. CATHODE
2. ANODE
3. N/C
4. N/C



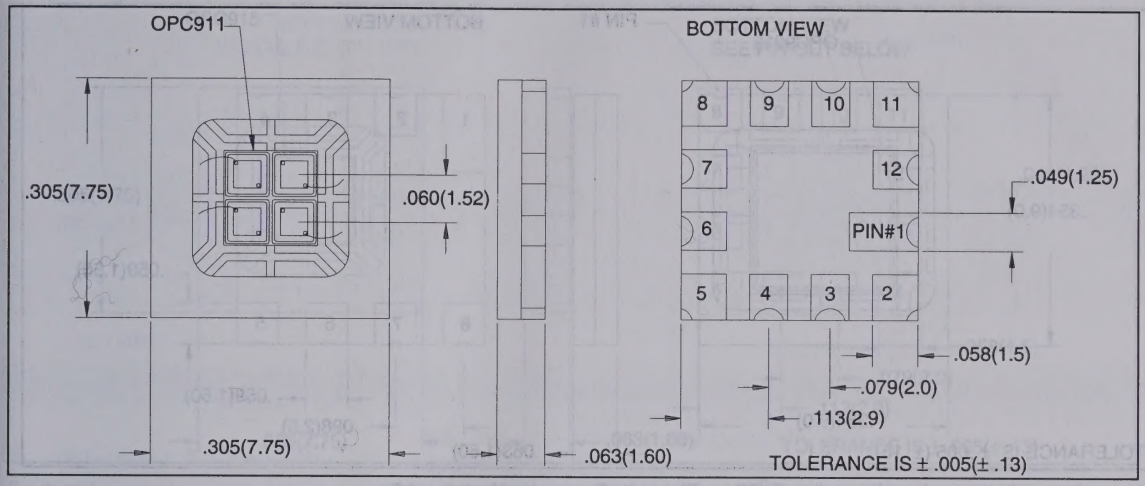

### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITION |
|---|---|---|---|---|---|---|
| $R_\lambda$ | Responsivity | .45 | | | A/W | $\Phi_e$ = 10 μW, λ = 890 nm, V = 0 |
| $V_{(BR)R}$ | Reverse Breakdown Voltage | 35 | | | V | $I_R$ = 100 μA |
| $I_D$ | Reverse Dark Current | | | 30 | nA | $V_R$ = 10 V |
| $C_T$ | Capacitance | | 25 | | pf | $V_R$ = 0 |
| L x W | Active Area | | .73 | | $mm^2$ | |

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

OPTEK

# Surface Mount Quad Photodiode
## Type OPR5911




### Features

- Surface Mountable
- Closely Matched Responsivity
- High Temperature Operation

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

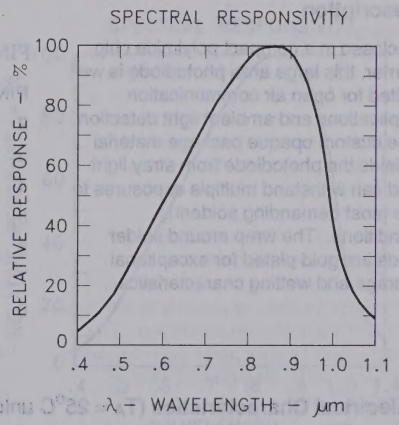
| | |
|---|---|
| Storage and Operating Temperature | -55°C to +125°C |
| Reverse Breakdown Voltage | 14V MIN. |
| Solder Temperature (Vapor Phase Reflow for 30 sec.) | 235°C |

### Description

Enclosed in a compact polyimide chip carrier, this four element photodiode is ideal for a variety of encoder and controls applications. The single chip construction insures excellent matching and very tight dimensional tolerances between the active areas. The custom opaque package material shields the photodiodes from stray light and can withstand multiple exposures to the most demanding soldering conditions. The wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

PIN OUT:

| | |
|---|---|
| PIN # 1. | ANODE #1 |
| 2. | COMMON CATHODE |
| 3. | N/C |
| 4. | N\C |
| 5. | COMMON CATHODE |
| 6. | ANODE #4 |
| 7. | ANODE #3 |
| 8. | COMMON CATHODE |
| 9. | N/C |
| 10. | N/C |
| 11. | COMMON CATHODE |



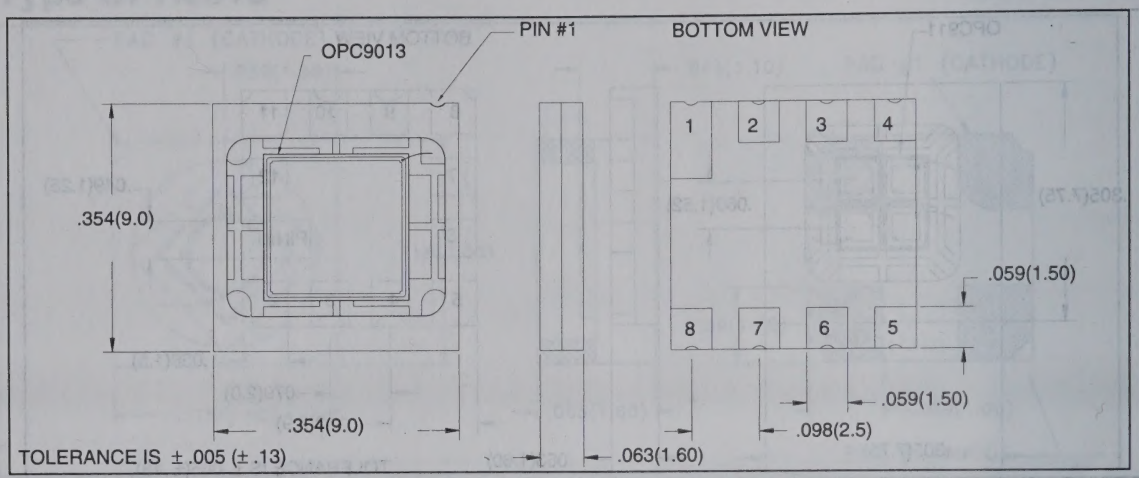

### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITION |
|---|---|---|---|---|---|---|
| $R_\lambda$ | Responsivity | .45 | | | A/W | $\Phi_e$ = 10 μW, λ = 890 nm, V = 0 |
| $V_{(BR)R}$ | Reverse Breakdown Voltage | 14 | | | V | $I_R$ = 100 μA |
| $I_D$ | Reverse Dark Current | | | 15 | nA | $V_R$ = 10 V |
| $C_T$ | Capacitance | | 10 | | pf | $V_R$ = 0 |
| L x W | Active Area (per diode) | | 1.0 | | $mm^2$ | (1.0 mm x 1.0 mm) |

HYBRID ASSEMBLIES

OPTEK

# Large Area SMD Silicon Photodiode
## Type OPR5913




### Features

- Surface Mountable
- Large Active Area
- High Temperature Operation

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

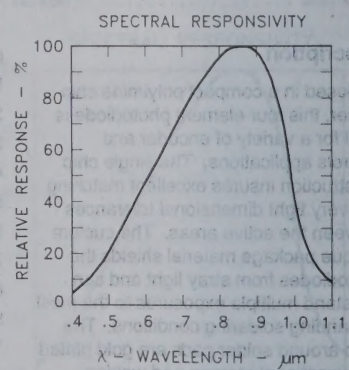
Storage and Operating Temperature ..... -55°C to +125°C.
Reverse Breakdown Voltage ..... 10V MIN.
Soldering Temperature (Vapor Phase Reflow for 30 sec.) ..... 235°C

### Description

Enclosed in a compact polyimide chip carrier, this large area photodiode is well suited for open air communication applications and ambient light detection. The custom opaque package material shields the photodiode from stray light and can withstand multiple exposures to the most demanding soldering conditions. The wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

### PIN OUT:

| | |
|---|---|
| PIN #1. | ANODE |
| 2. | COMMON CATHODE |
| 3. | COMMON CATHODE |
| 4. | N/C |
| 5. | N/C |
| 6. | COMMON CATHODE |
| 7. | COMMON CATHODE |
| 8. | N/C |

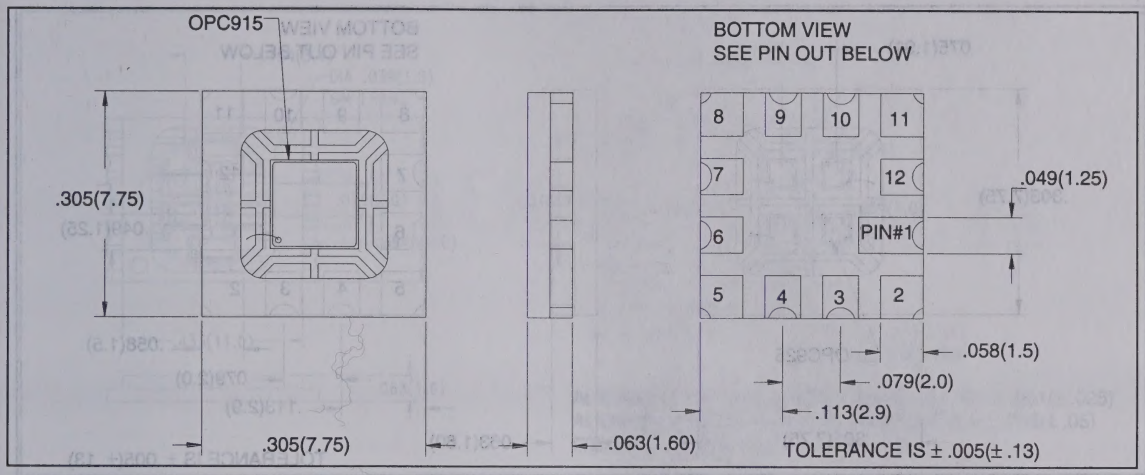



### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITION |
|---|---|---|---|---|---|---|
| $R_\lambda$ | Responsivity | .40 | | | A/W | $\Phi_e$ = 10 μW, λ = 890 nm, V = 0 |
| $V_{(BR)R}$ | Reverse Breakdown Voltage | 10 | | | V | $I_R$ = 100 μA |
| $I_D$ | Reverse Dark Current | | | 100 | nA | $V_R$ = 0.5 V |
| $C_T$ | Capacitance | | 1000 | | pf | $V_R$ = 0 V |
| | | | 250 | | pf | $V_R$ = 10 V |
| L x W | Active Area | | 25 | | $mm^2$ | (5.0 mm x 5.0 mm) |

OPTEK

# Surface Mount Silicon PIN Photodiode
## Type OPR5915




### Features

- Surface Mountable
- Large Active Area
- High Temperature Operation

### Description

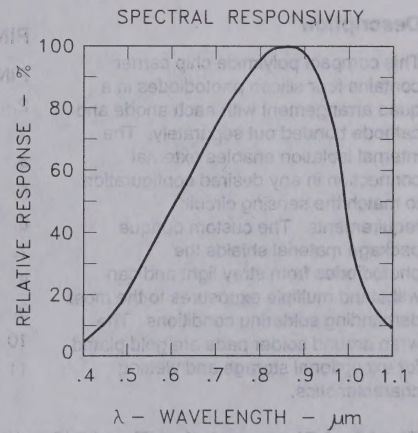
Enclosed in a compact polyimide chip carrier, this large area photodiode is well suited for open air communication applications and ambient light detection. Peak responsivity at the wavelength of 880 nm results in maximum coupling efficiency with Optek GaAlAs LEDs. The custom opaque package material shields the photodiode from stray light and can withstand multiple exposures to the most demanding soldering conditions. The wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature ..... -55°C to +125°C
Reverse Breakdown Voltage ..... 35V MIN.
Solder Temperature (Vapor Phase Reflow for 30 sec.) ..... 235°C

### PIN OUT:

| | |
|---|---|
| PIN #1. | ANODE |
| 2. | COMMON CATHODE |
| 3. | N/C |
| 4. | N/C |
| 5. | COMMON CATHODE |
| 6. | N/C |
| 7. | N/ |
| 8. | COMMON CATHODE |
| 9. | N/C |
| 10. | N/C |
| 11. | COMMON CATHODE |

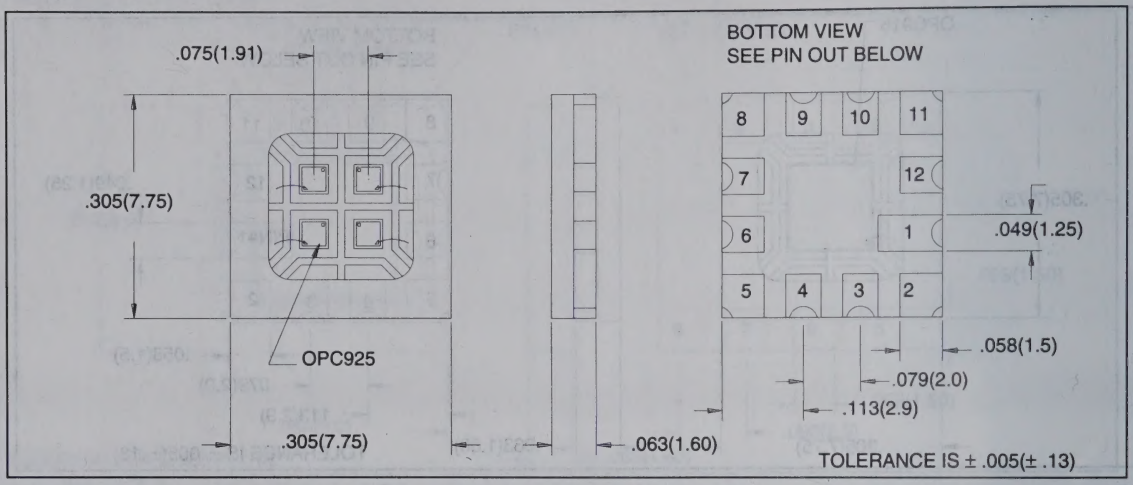



### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITION |
|---|---|---|---|---|---|---|
| $R_\lambda$ | Responsivity | .45 | | | A/W | $\Phi_e$ = 10 μW, λ = 890 nm, V = 0 |
| $V_{(BR)R}$ | Reverse Breakdown Voltage | 35 | | | V | $I_R$ = 100 μA |
| $I_D$ | Reverse Dark Current | | | 30 | nA | $V_R$ = 10 V |
| $C_T$ | Capacitance | | 125 | | pf | $V_R$ = 0 |
| L x W | Active Area | | 7.3 | | $mm^2$ | (2.7 mm x 2.7 mm) |

HYBRID ASSEMBLIES

# Surface Mount Quad Photodiode
## Type OPR5925




### Features

- Surface Mountable
- Separate Cathode Connections
- High Temperature Operation

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

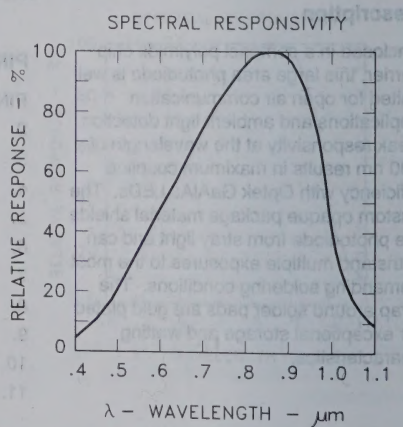
| | |
|---|---|
| Storage and Operating Temperature | -55°C to +125°C |
| Reverse Breakdown Voltage | 35V MIN. |
| Solder Temperature (Vapor Phase Reflow for 30 sec.) | 235°C |

### Description

This compact polyimide chip carrier contains four silicon photodiodes in a quad arrangement with each anode and cathode bonded out separately. The internal isolation enables external connection in any desired configuration to match the sensing circuit requirements. The custom opaque package material shields the photodiodes from stray light and can withstand multiple exposures to the most demanding soldering conditions. The wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

### PIN OUT:

| | |
|---|---|
| PIN #1. | ANODE #1 |
| 2. | CATHODE #1 |
| 3. | N/C |
| 4. | N/C |
| 5. | CATHODE #2 |
| 6. | ANODE #2 |
| 7. | ANODE #3 |
| 8. | CATHODE #3 |
| 9. | N/C |
| 10. | N/C |
| 11. | CATHODE #4 |

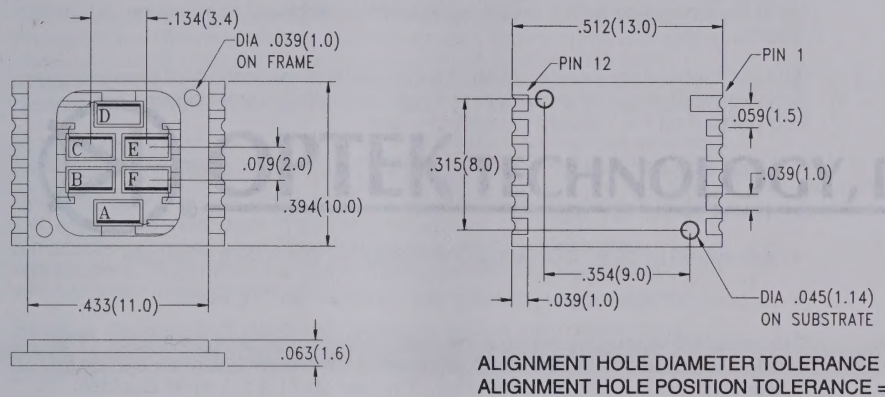



### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITION |
|---|---|---|---|---|---|---|
| $R_\lambda$ | Responsivity | .45 | | | A/W | $\Phi_e$ = 10 μW, λ = 890 nm, $V_R$ = 0 V |
| $V_{(BR)R}$ | Reverse Breakdown Voltage | 35 | | | V | $I_R$ = 100 μA |
| $I_D$ | Reverse Dark Current | | | 30 | nA | $V_R$ = 10 V |
| $C_T$ | Capacitance | | 10 | | pf | $V_R$ = 10 V |
| L x W | Active Area (per diode) | | 0.64 | | $mm^2$ | (0.8 mm x 0.8 mm) |

OPTEK

# Six Element SMD Photodiode Array
## Type OPR5929




ALIGNMENT HOLE DIAMETER TOLERANCE = ± .001(± .025)
ALIGNMENT HOLE POSITION TOLERANCE = ± .002(± .05)
OTHER TOLERANCES = ± .005(± .13)

### Features

- Surface Mountable
- Closely Matched Responsivity
- High Temperature Operation

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

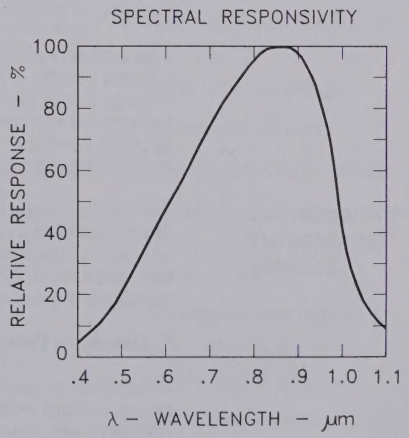
Storage and Operating Temperature ..... -55°C to +125°C
Reverse Breakdown Voltage ..... 50V MIN.
Solder Temperature (Vapor Phase Reflow for 30 sec.) ..... 235°C

### Description

Enclosed in a compact polyimide chip carrier, this six element photodiode has been specifically designed to meet the needs of motor encoder applications. Six individual chips are mounted on isolated cathode contacts to allow external connection in any desired configuration. The custom opaque package material shields the photodiodes from stray light and can withstand multiple exposures to the most demanding soldering conditions. The wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

### PIN OUT:

| | |
|---|---|
| PIN #1. | CATHODE D |
| 2. | ANODE D |
| 3. | ANODE C |
| 4. | CATHODE C |
| 5. | CATHODE B |
| 6. | ANODE B |
| 7. | CATHODE A |
| 8. | ANODE A |
| 9. | ANODE F |
| 10. | CATHODE F |
| 11. | CATHODE E |



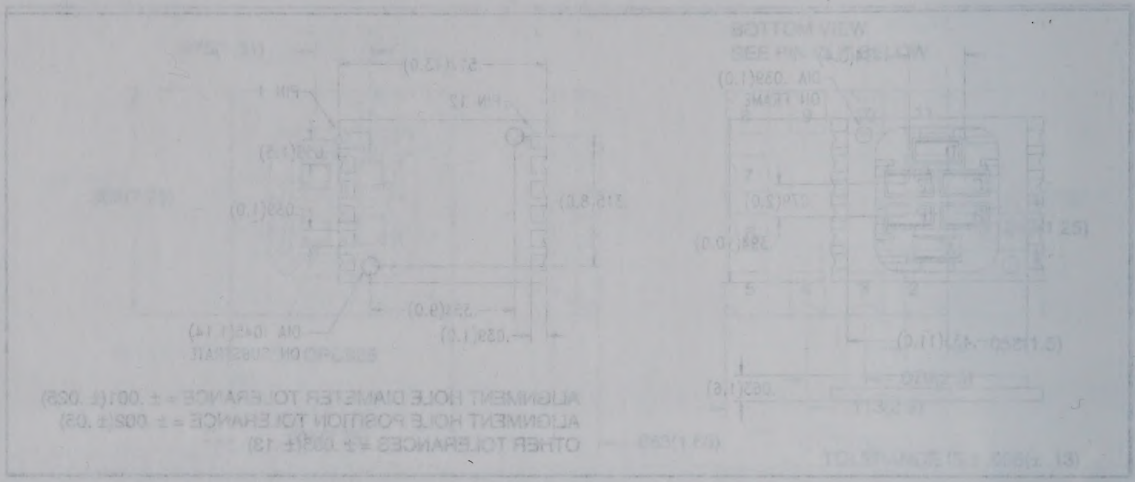

### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETERS | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $R_\lambda$ | Responsivity | .45 | | | A/W | $\Phi_e$ = 10 μW, λ = 890 nm, V = 0 |
| $V_{(BR)R}$ | Reverse Breakdown Voltage | 50 | | | V | $I_R$ = 100 μA |
| $I_D$ | Reverse Dark Current | | | 10 | nA | $V_R$ = 10 V |
| $C_T$ | Capacitance | | 10 | | pf | $V_R$ = 10 V |
| L x W | Active Area (per diode) | | 2.9 | | $mm^2$ | (1.1 mm x 2.6 mm) |

HYBRID ASSEMBLIES

# Six Element SMD Photodiode Array

## Type OPR5925



OPTEK TECHNOLOGY, INC.

# HALL EFFECT SENSORS



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Hallogic™ Hall Effect Sensors

Optek Technology, Inc. produces temperature-compensated Hall effect magnetic sensing devices. The Hallogic™ Hall Effect Sensors are superior products that meet the demands of motion sensing in extremely harsh environments such as under-the-hood automotive and heavy industrial machinery applications, including robotics.

Hallogic™ refers to the combination of a Hall element magnetic field sensor with highly refined integrated circuitry on a single, monolithic bipolar silicon chip. Incorporated on the Hallogic™ sensor chip are:

- a Hall element
- a bandgap voltage regulator
- a threshold amplifier including a linear amplifier and a Schmitt trigger
- an open-collector output transistor that can drive ten TTL loads

## The Hall Element

The basic Hall element relies on a magnetic field in order to sense motion. The principle is based on the Hall effect, discovered more than 100 years ago by the American physicist, Edwin Herbert Hall. The Hall effect is the small electrical potential created when a stationary magnetic field is placed perpendicular to a current-carrying conductor (see Figure 1).

Most available Hall elements hold current constant and measure voltage, which is then correlated with magnetic field strength. The superior performance of the Optek device is due in part to a fundamental design change which instead provides a constant bias *voltage* and measures the Hall *current*. This method proves more accurate for sensing magnetic field strength when temperature varies. It also provides a better way to interface the Hall element with the complex integrated circuitry of the Hallogic™ sensor.

The Optek Hall element then is basically a block of semiconductor material with four contact points. Two contacts (or electrodes) are used to supply a constant bias voltage to the element; the other two are used for the varying current output. If voltage is held constant across the device while a perpendicular magnetic field is applied, the Hall current can be sensed across the output connections. The Hall current is proportional to the strength of the applied magnetic field.

## Unprecedented Temperature Stability

Temperature coefficients have been optimized to insure stable electrical characteristics over the temperature range of -55°C to +150°C. Other design aspects of the Hallogic™ sensor that enable it to meet Optek's demanding temperature stability objectives are two important circuit areas on the chip, the bandgap regulator and the threshold amplifier:

**1. Bandgap Voltage Regulator:**

In addition to maintaining a constant output voltage level (no matter what changes occur in input voltage or output current), the Optek Hallogic™ bandgap voltage regulator also serves as an extremely good temperature compensated voltage source to bias the Hall element. This bandgap voltage regulator enables Hallogic™ devices to operate with a supply voltage ranging from 4.5 to 24 volts DC, with virtually no drift in magnetic sensitivity (i.e., in the magnetic trigger point).

**2. Threshold Amplifier:**

The amplifier/detector circuit is a constant-gain type, designed with temperature-compensated trip points at the input to the voltage comparator. The Schmitt trigger output then drives an open-collector transistor with a 50 mA current sinking capability. This open-collector transistor enables the device output to drive up to ten TTL loads directly.

## Low Power Consumption

Yet another advantage is the low power consumption, which results from no bias current being required by the permanent magnet. The sensor itself draws only 5 mA (typical) of supply current ($I_{CC}$).

## Package Design

Optek uses a very high density transfer molded plastic to encapsulate the Hallogic™ lead frame and chip. Both the density and the transfer molding process result in a dirt and moisture barrier effective enough to pass Military Standard 883. The sensor passes "pressure cooker" and similar moisture and temperature testing procedures to insure a reliable product.

In addition, the lead frame is designed with superior thermal characteristics for maximum reliability at the ten TTL load capability of the device.

The dimensional outline of the package and the precise placement of the Hall element are standard. This design allows for the superior, temperature compensated Optek device to be specified for instant replacement. A significant upgrade in performance can be achieved without costly redesign and retooling.

Because the Hallogic™ Hall Effect Sensor is smaller than conventional emitter-detector pairs, it will more easily fit into areas with small size constraints.

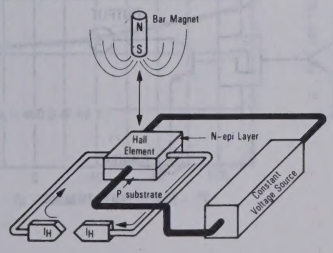
## Designed for the Toughest Environments

The result is that the Hallogic™ Hall Effect Sensor is virtually immune to environmental contaminants. It is rugged and suitable for use under severe service conditions. Even in the toughest environment, the Hallogic™ sensor will exhibit excellent magnetic sensitivity to provide reliable, repetitive operations in close tolerance applications. These devices are excellent choices for DC motors, automotive applications, robotic and heavy machinery sensing applications, or for any application in a harsh environment where optoelectronic devices are unsuitable.

## Custom Sensor Assemblies

Optek offers the customer the same custom assembly capability they have come to expect from the Optoelectronic division. Custom designed sensors with Hall effect devices and magnets, long lead wires, special connectors etc., are available. With Optek's complete plastic tooling and molding operations, Hall Effect sensors are available in a wide variety of hybrid packages.

**Figure 1. Basic Hall Element**




## Typical Applications

Appliances

Automotive OEM & Aftermarket

Business machines

Communications

Computers/peripherals

Controls

DC motors & electrical motor controls

Entertainment products

Industrial and commercial switches

Instrumentation

Machinery

Machine tools

Military systems and equipment

Power supplies

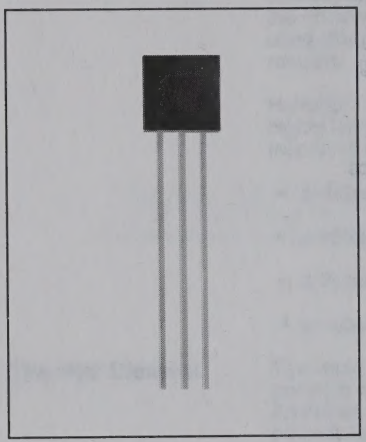
Test equipment

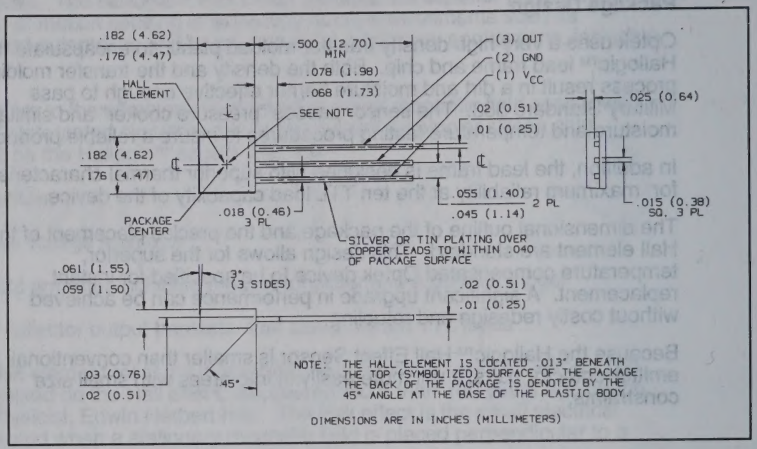


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Hallogic™ Hall Effect Sensors
## Type OH090U






### Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 10 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

### Description

The OH090U contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 30 mA of sink current. This allows direct driving of more than 10 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OH090U is a high performance device capable of operation from -40°C to +150°C. Stability of the magnetic operate and release points is excellent over this entire temperature range.

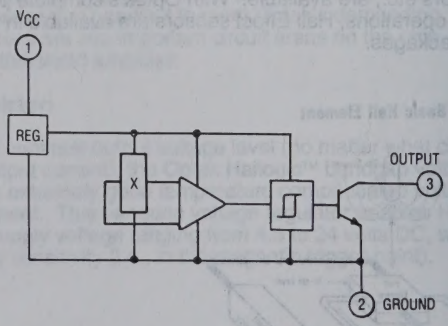
Package size has been kept to minimum, providing an advantage in applications where space is limited.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +160°C |
| Operating Temperature Range, $T_A$ | -40°C to +150°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Output ON Current, $I_{SINK}$ | 50mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



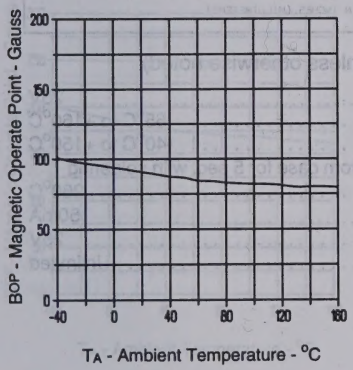
# Type OH090U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 VDC, $T_A$ = 25°C unless otherwise noted)

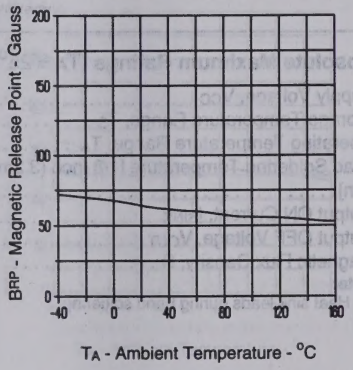
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | 0 | 90 | 180 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | -100 | 65 | 100 | Gauss | |
| $B_H$ | Magnetic Hysteresis | 10 | 25 | 100 | Gauss | |
| $I_{CC}$ | Supply Current | | 6 | 9 | mA | $V_{CC}$ = 24 V, Output On |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 300 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 30 mA |
| $I_{OH}$ | Output Leakage Current | | 0.50 | 10.0 | µA | $V_{CC}$ = 24 V, $V_{OUT}$ = 24 V |
| $t_r$ | Output Rise Time | | 0.30 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF |
| $t_f$ | Output Fall Time | | 0.30 | 1.00 | µs | |

## Typical Performance Curves

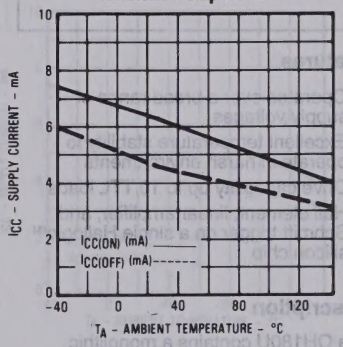
**Magnetic Operate Point vs Ambient Temperature**



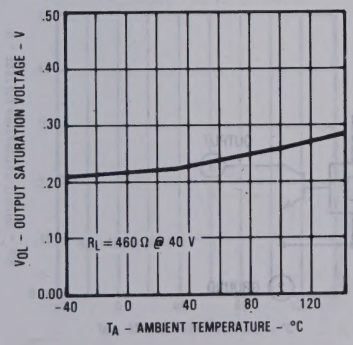

**Magnetic Release Point vs Ambient Temperature**



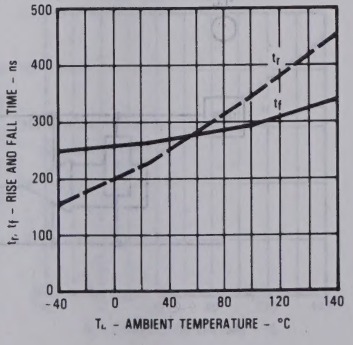

**Supply Current vs Ambient Temperature**



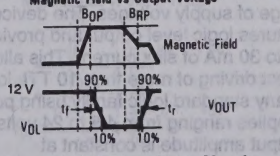

**Output Saturation Voltage vs Ambient Temperature**



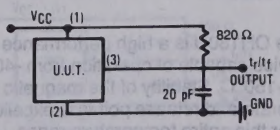

**Rise and Fall Time vs Ambient Temperature**




**Rise and Fall Time Tests**

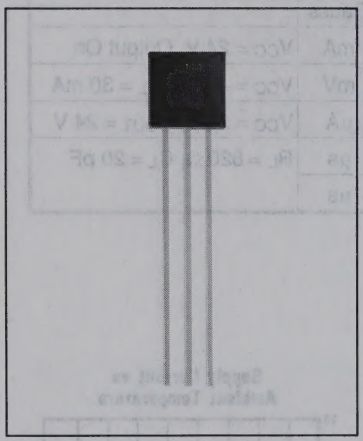


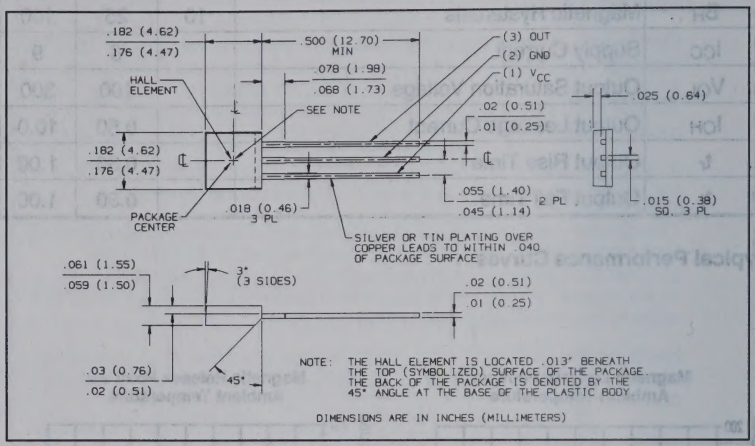

**Rise and Fall Time Test Circuit**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Hallogic™ Hall Effect Sensors
## Type OH180U






### Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 10 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

### Description

The OH180U contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 30 mA of sink current. This allows direct driving of more than 10 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OH180U is a high performance device capable of operation from -40°C to +150°C. Stability of the magnetic operate and release points is excellent over this entire temperature range.

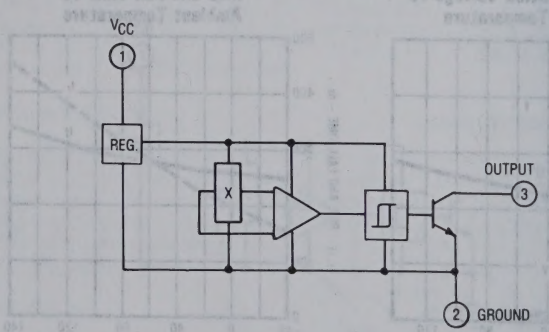
Package size has been kept to minimum, providing an advantage in applications where space is limited.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +160°C |
| Operating Temperature Range, $T_A$ | -40°C to +150°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C |
| Output ON Current, $I_{SINK}$ | 50mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



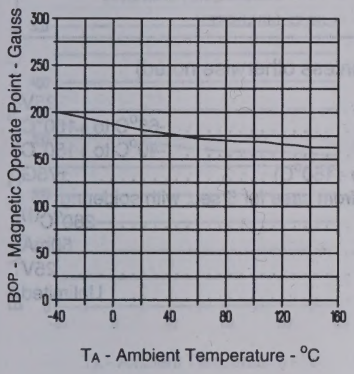
# Type OH180U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 VDC, $T_A$ = 25°C unless otherwise noted)

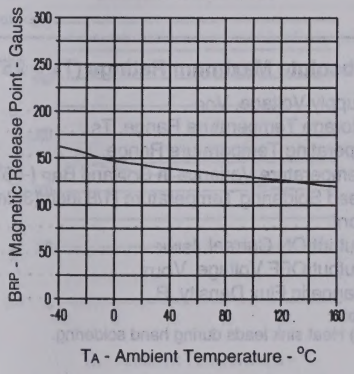
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | 70 | 180 | 290 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | 0 | 140 | 230 | Gauss | |
| $B_H$ | Magnetic Hysteresis | 20 | 40 | 120 | Gauss | |
| $I_{CC}$ | Supply Current | | 6 | 9 | mA | $V_{CC}$ = 24 V, Output On |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 300 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 30 mA |
| $I_{OH}$ | Output Leakage Current | | 0.50 | 10.0 | µA | $V_{CC}$ = 24 V, $V_{OUT}$ = 24 V |
| $t_r$ | Output Rise Time | | 0.30 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF |
| $t_f$ | Output Fall Time | | 0.30 | 1.00 | µs | |

## Typical Performance Curves

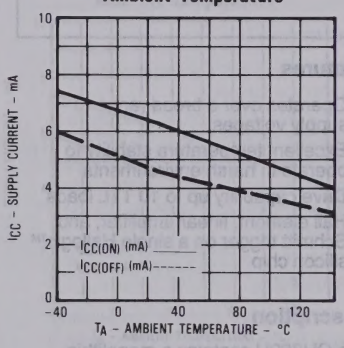
**Magnetic Operate Point vs Ambient Temperature**



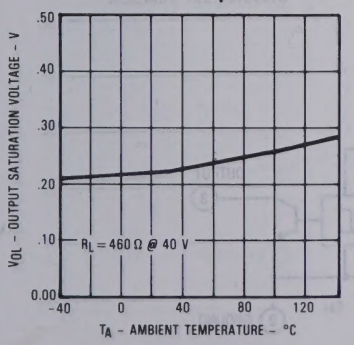

**Magnetic Release Point vs Ambient Temperature**



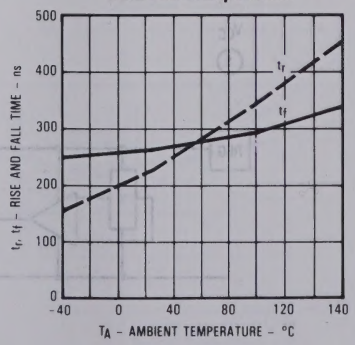

**Supply Current vs Ambient Temperature**



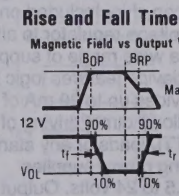

**Output Saturation Voltage vs Ambient Temperature**



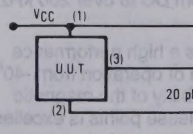

**Rise and Fall Time vs Ambient Temperature**




**Rise and Fall Time Tests**




**Rise and Fall Time Test Circuit**

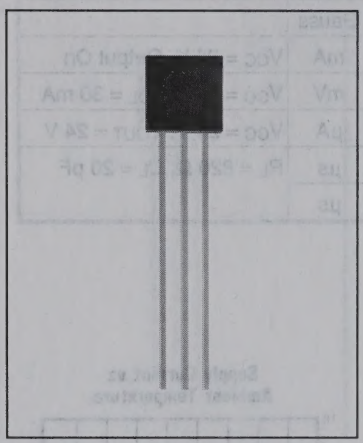


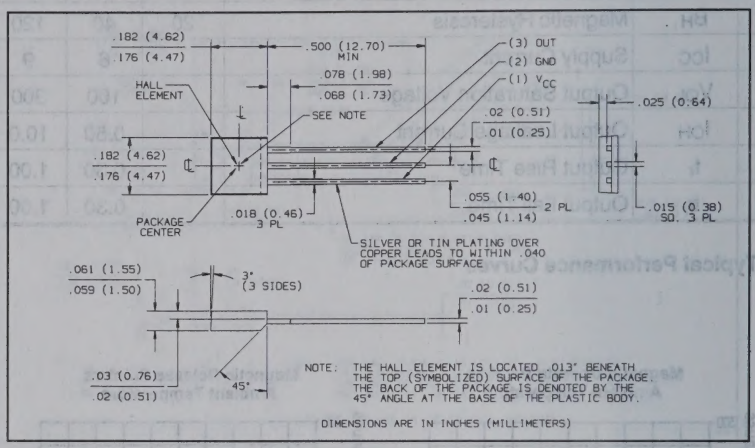



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Hallogic™ Hall Effect Sensors
## Type OH360U






### Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 10 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

### Description

The OH360U contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, a threshold amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 30 mA of sink current. This allows direct driving of more than 10 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OH360U is a high performance device capable of operation from -40°C to +150°C. Stability of the magnetic operate and release points is excellent over this entire temperature range.

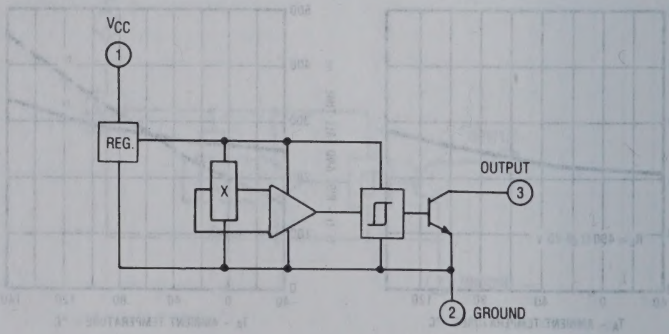
Package size has been kept to minimum, providing an advantage in applications where space is limited.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +160°C |
| Operating Temperature Range, $T_A$ | -40°C to +150°C |
| Temperature Variance in $B_{OP}$ and $B_{RP}$ (-55°C to +150°C) | ±75G |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Output ON Current, $I_{SINK}$ | 50mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram




Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

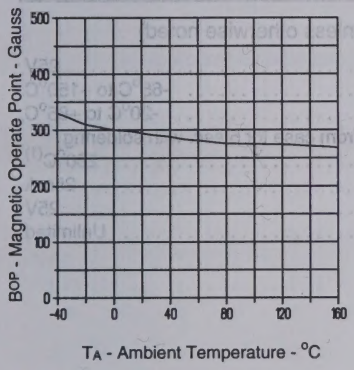
# Type OH360U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 VDC, $T_A$ = 25°C unless otherwise noted)

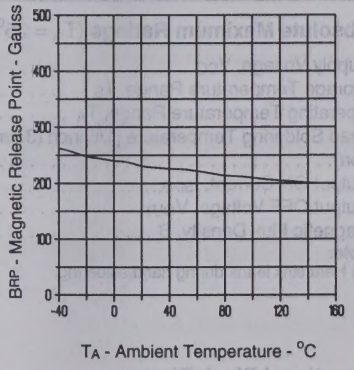
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | 235 | 300 | 465 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | 120 | 235 | 325 | Gauss | |
| $B_H$ | Magnetic Hysteresis | 30 | 65 | 200 | Gauss | |
| $I_{CC}$ | Supply Current | | 6 | 9 | mA | $V_{CC}$ = 24 V, Output On |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 300 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 30 mA |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 24 V, $V_{OUT}$ = 24 V |
| $t_r$ | Output Rise Time | | 0.3 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF, |
| $t_f$ | Output Fall Time | | 0.3 | 1.00 | µs | $V_{CC}$ = 14.0 V |

## Typical Performance Curves

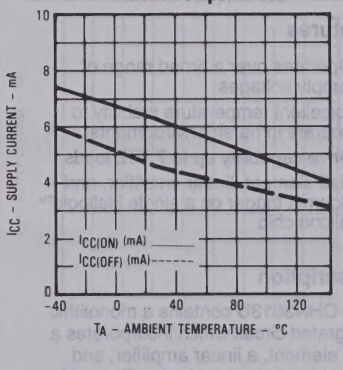
**Magnetic Operate Point vs Ambient Temperature**



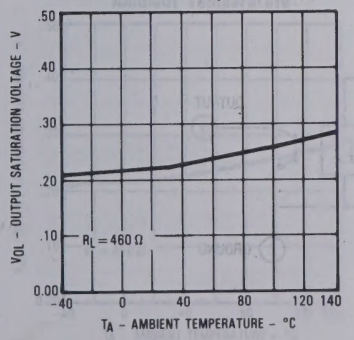

**Magnetic Release Point vs Ambient Temperature**



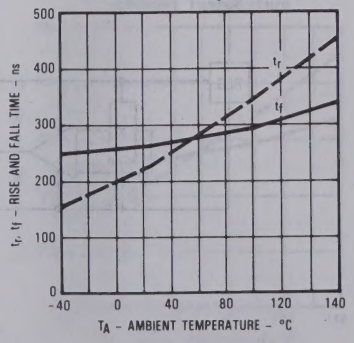

**Supply Current vs Ambient Temperature**



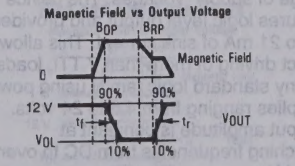

**Output Saturation Voltage vs Ambient Temperature**



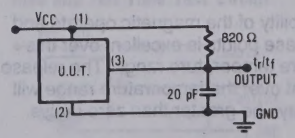

**Rise and Fall Time vs Ambient Temperature**




**Rise and Fall Time Tests**

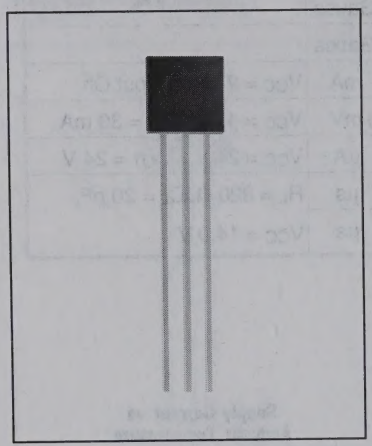


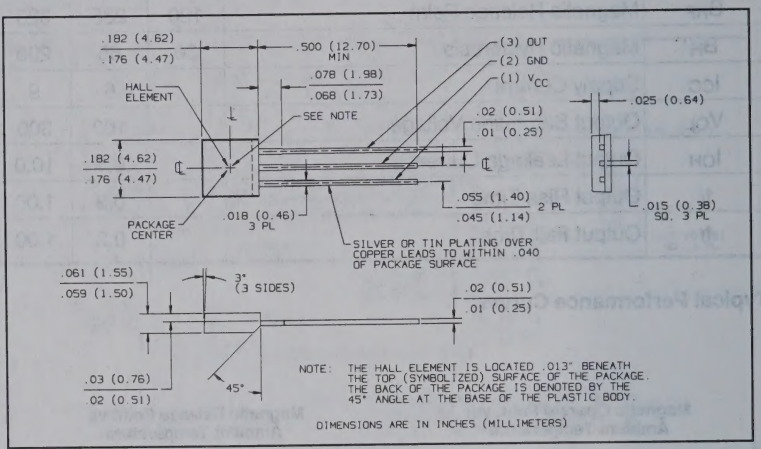

**Rise and Fall Time Test Circuit**




HALL EFFECT SENSORS

# Hallogic™ Hall Effect Sensors
## Type OHN3013U






### Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

### Description

The OHN3013U contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

Stability of the magnetic operate and release points is excellent over this entire temperature range. The release point over the temperature range will always be greater than zero gauss.

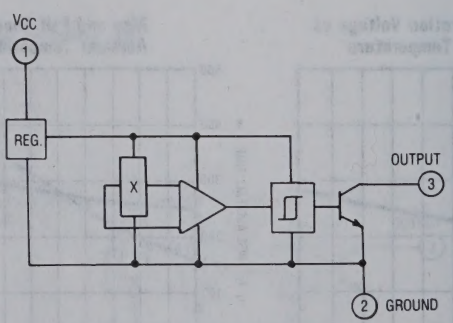
Package size has been kept to minimum, providing an advantage in applications where space is limited.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ | -20°C to +85°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



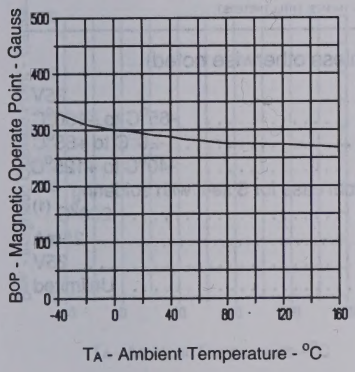
# Type OHN3013U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 VDC, $T_A$ = 25°C unless otherwise noted)

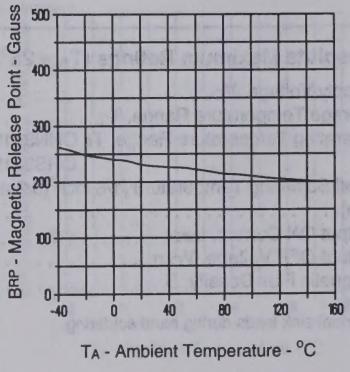
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | | 300 | 450 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | 25 | 235 | | Gauss | |
| $B_H$ | Magnetic Hysteresis | 30 | 65 | | Gauss | |
| $I_{CC}$ | Supply Current | | 4 | 7 | mA | $V_{CC}$ = 24 V, Output Off |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 400 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 20 mA, B ≥ 450 Gauss |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 24 V, $V_{OUT}$ = 24 V, B ≤ 25 Gauss |
| $t_r$ | Output Rise Time | | 0.21 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF |
| $t_f$ | Output Fall Time | | 0.25 | 1.00 | µs | |

## Typical Performance Curves

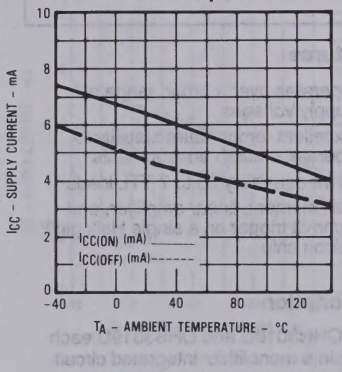
**Magnetic Operate Point vs Ambient Temperature**



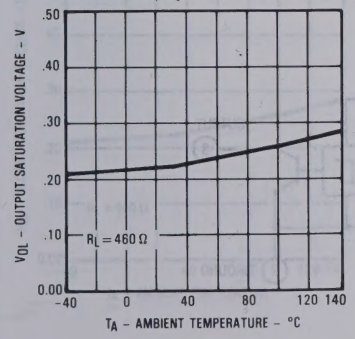

**Magnetic Release Point vs Ambient Temperature**



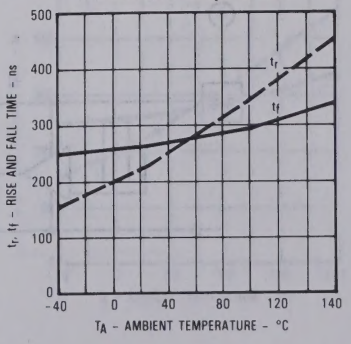

**Supply Current vs Ambient Temperature**



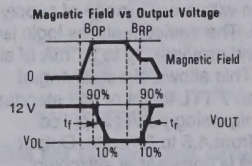

**Output Saturation Voltage vs Ambient Temperature**



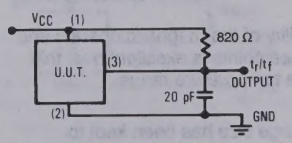

**Rise and Fall Time vs Ambient Temperature**




**Rise and Fall Time Tests**

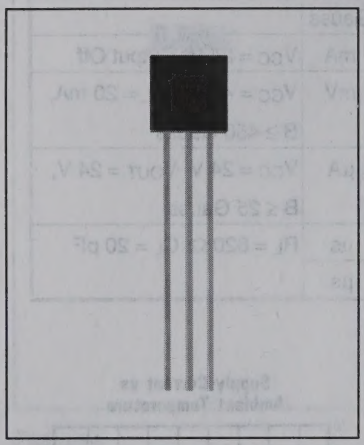


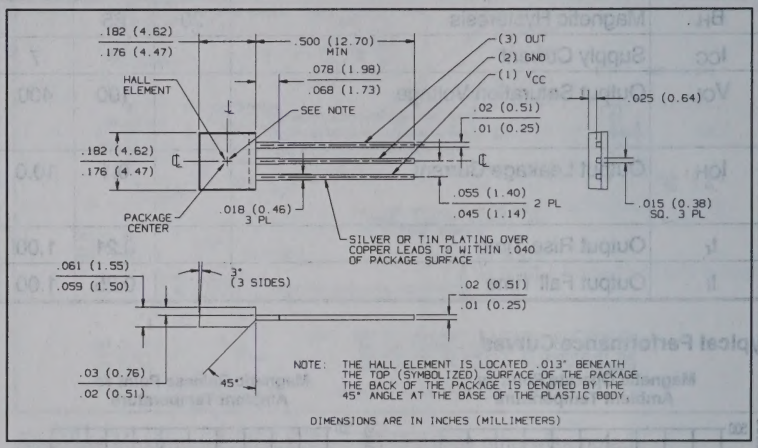

**Rise and Fall Time Test Circuit**




HALL EFFECT SENSORS

# Hallogic™ Hall Effect Sensors
## Types OHN3019U, OHS3019U






### Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

### Description

The OHN3019U and OHS3019U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

Stability of the magnetic operate and release points is excellent over this entire temperature range.

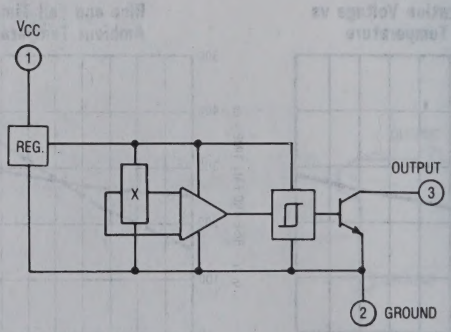
Package size has been kept to minimum, providing an advantage in applications where space is limited.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ OHN3019U | -20°C to +85°C |
| OHS3019U | -40°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C (1) |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



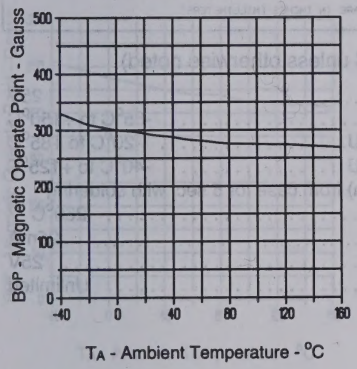
# Types OHN3019U, OHS3019U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 VDC, $T_A$ = 25°C unless otherwise noted)

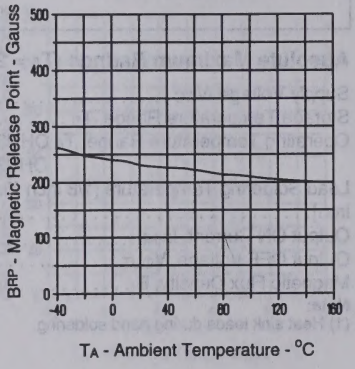
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | | 300 | 500 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | 125 | 235 | | Gauss | |
| $B_H$ | Magnetic Hysteresis | 50 | 65 | | Gauss | |
| $I_{CC}$ | Supply Current | | 4 | 7 | mA | $V_{CC}$ = 24 V, Output Off |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 400 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 20 mA, B ≥ 500 Gauss |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 24 V, $V_{OUT}$ = 24 V, B ≤ 100 Gauss |
| $t_r$ | Output Rise Time | | 0.21 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF |
| $t_f$ | Output Fall Time | | 0.25 | 1.00 | µs | |

## Typical Performance Curves

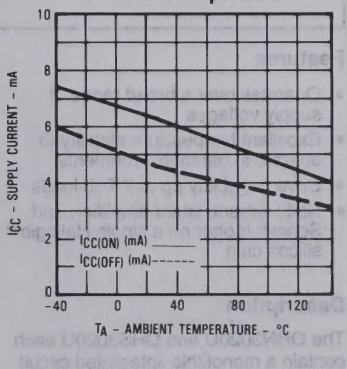
**Magnetic Operate Point vs Ambient Temperature**



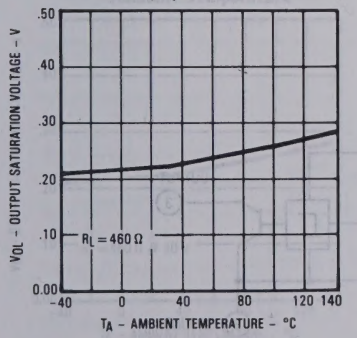

**Magnetic Release Point vs Ambient Temperature**



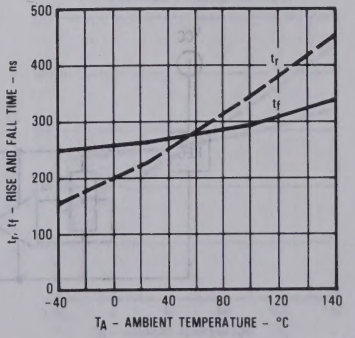

**Supply Current vs Ambient Temperature**



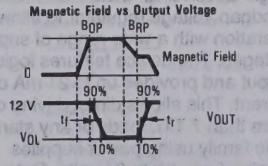

**Output Saturation Voltage vs Ambient Temperature**



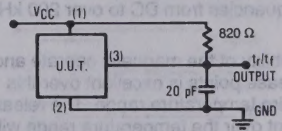

**Rise and Fall Time vs Ambient Temperature**




**Rise and Fall Time Tests**



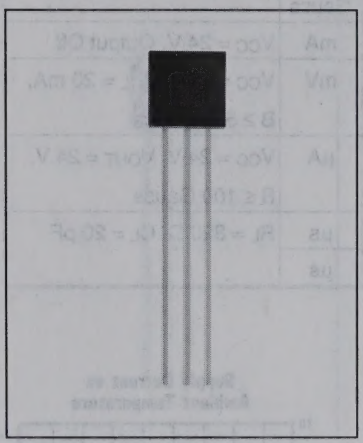

**Rise and Fall Time Test Circuit**

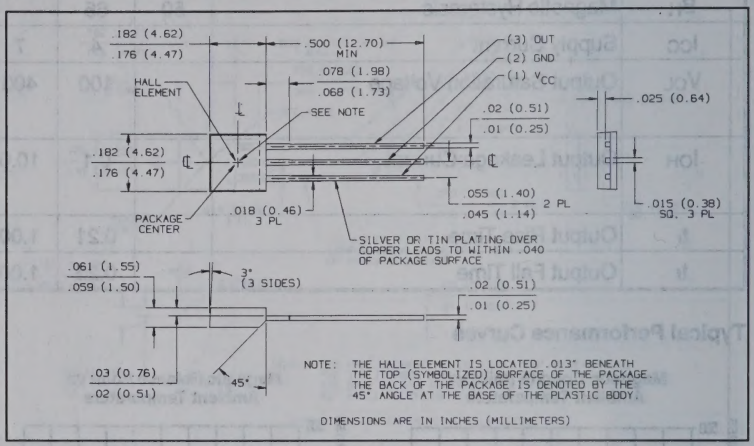



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Hallogic™ Hall Effect Sensors
## Types OHN3020U, OHS3020U






### Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

### Description

The OHN3020U and OHS3020U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

Stability of the magnetic operate and release points is excellent over this entire temperature range. The release point over the temperature range will always be greater than zero gauss.

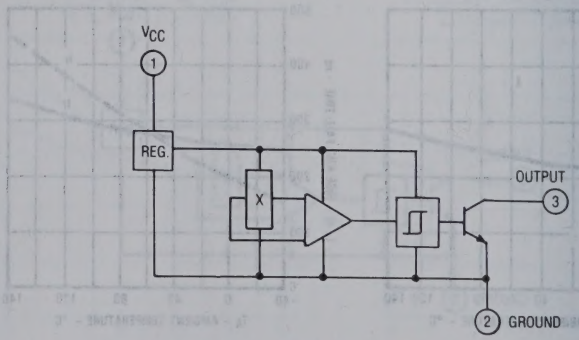
Package size has been kept to minimum, providing an advantage in applications where space is limited.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ OHN3020U | -20°C to +85°C |
| OHS3020U | -40°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C (1) |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



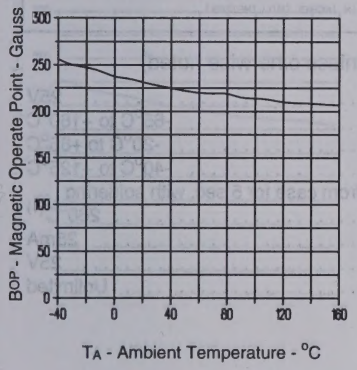
# Types OHN3020U, OHS3020U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 VDC, $T_A$ = 25°C unless otherwise noted)

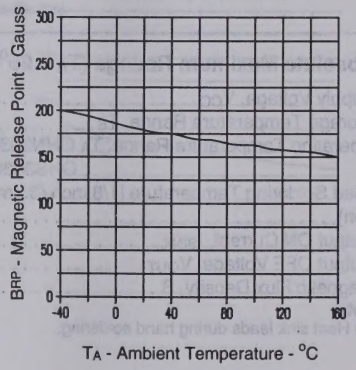
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | | 230 | 350 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | 50 | 180 | | Gauss | |
| $B_H$ | Magnetic Hysteresis | 20 | 50 | | Gauss | |
| $I_{CC}$ | Supply Current | | 4 | 7 | mA | $V_{CC}$ = 24 V, Output Off |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 400 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 20 mA, B ≥ 350 Gauss |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 24 V, $V_{OUT}$ = 24 V, B ≤ 50 Gauss |
| $t_r$ | Output Rise Time | | 0.21 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF |
| $t_f$ | Output Fall Time | | 0.25 | 1.00 | µs | |

## Typical Performance Curves

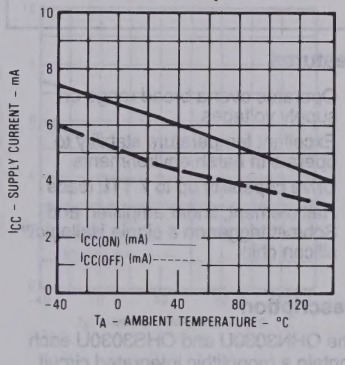
**Magnetic Operate Point vs Ambient Temperature**



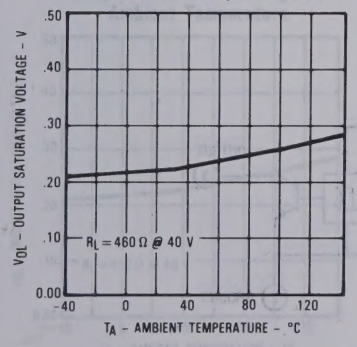

**Magnetic Release Point vs Ambient Temperature**



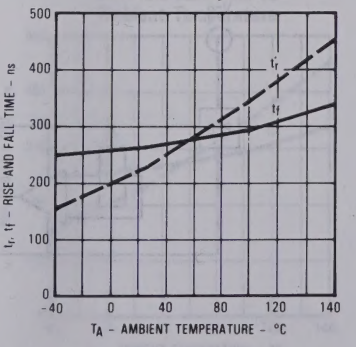

**Supply Current vs Ambient Temperature**



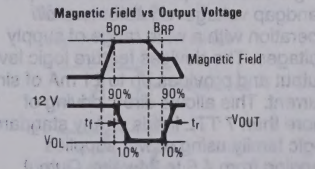

**Output Saturation Voltage vs Ambient Temperature**



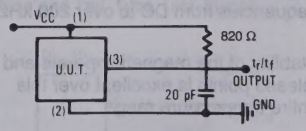

**Rise and Fall Time vs Ambient Temperature**




**Rise and Fall Time Tests**

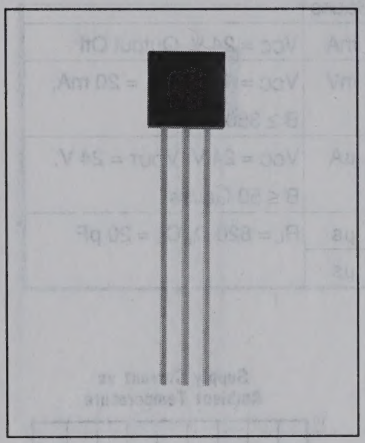


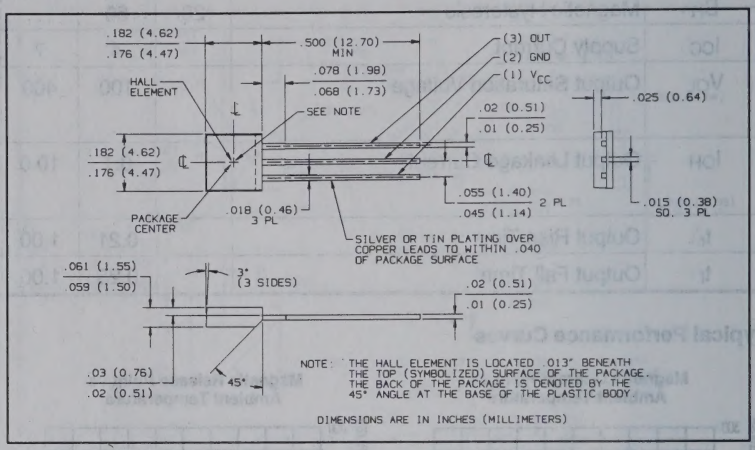

**Rise and Fall Time Test Circuit**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Hallogic™ Hall Effect Sensors
## Types OHN3030U, OHS3030U






### Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

### Description

The OHN3030U and OHS3030U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

Stability of the magnetic operate and release points is excellent over this entire temperature range.

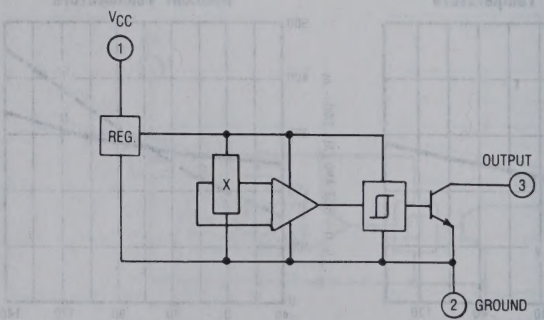
Package size has been kept to minimum, providing an advantage in applications where space is limited.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +160°C |
| Operating Temperature Range, $T_A$ OHN3030U | -20°C to +85°C |
| OHS3030U | -40°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



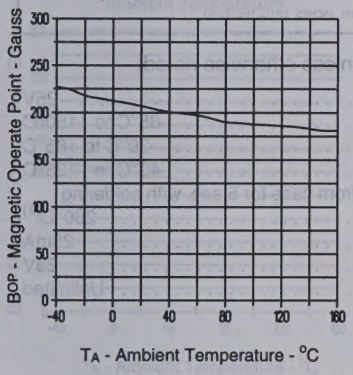
# Types OHN3030U, OHS3030U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 V, $T_A$ = 25°C unless otherwise noted)

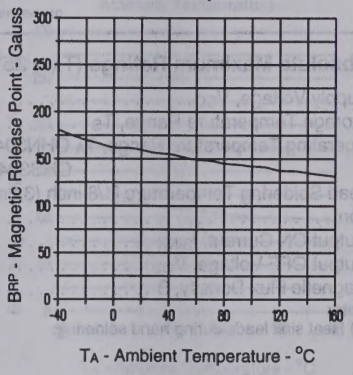
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | | 205 | 250 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | 0 | 160 | | Gauss | |
| $B_H$ | Magnetic Hysteresis | 20 | 45 | | Gauss | |
| $I_{CC}$ | Supply Current | | 4 | 7 | mA | $V_{CC}$ = 24 V, Output Off |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 400 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 20 mA, B ≥ 200 Gauss |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 24 V, $V_{OUT}$=24 V, B ≤ 50 Gauss |
| $t_r$ | Output Rise Time | | 0.21 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF |
| $t_f$ | Output Fall Time | | 0.25 | 1.00 | µs | |

## Typical Performance Curves

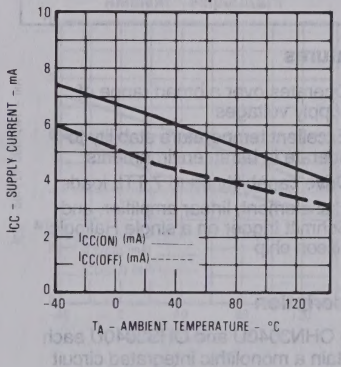
**Magnetic Operate Point vs Ambient Temperature**



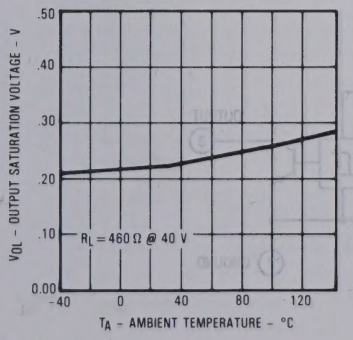

**Magnetic Release Point vs Ambient Temperature**



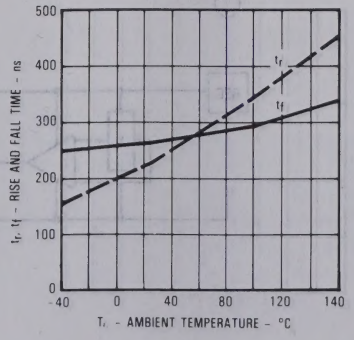

**Supply Current vs Ambient Temperature**



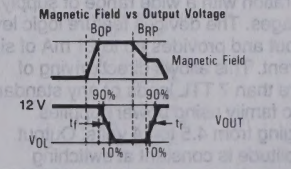

**Output Saturation Voltage vs Ambient Temperature**



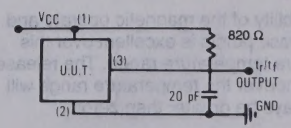

**Rise and Fall Time vs Ambient Temperature**




**Rise and Fall Time Tests**




**Rise and Fall Time Test Circuit**

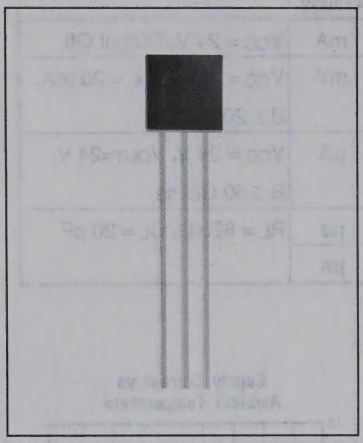


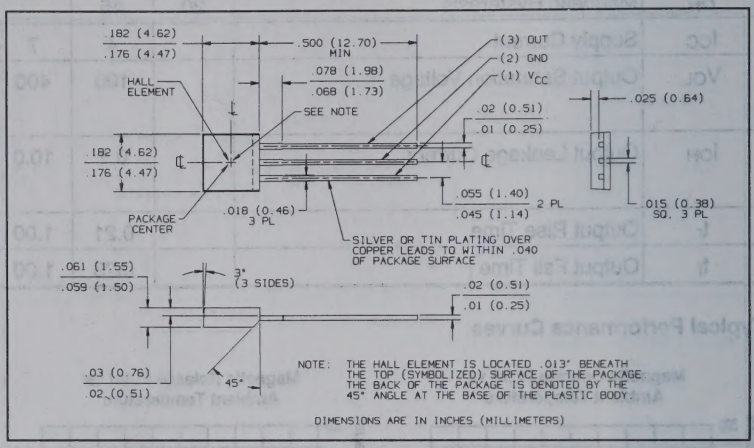



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Hallogic™ Hall Effect Sensors
## Types OHN3040U, OHS3040U






### Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

### Description

The OHN3040U and OHS3040U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

Stability of the magnetic operate and release points is excellent over this entire temperature range. The release point over the temperature range will always be greater than zero.

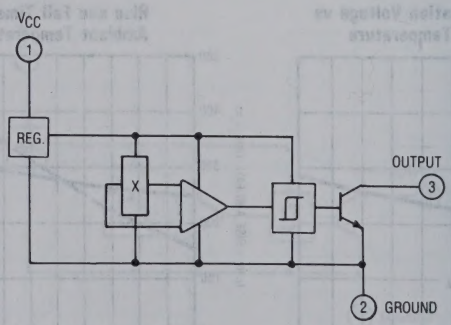
Package size has been kept to minimum, providing an advantage in applications where space is limited.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ OHN3040U | -20°C to +85°C |
| OHS3040U | -40°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



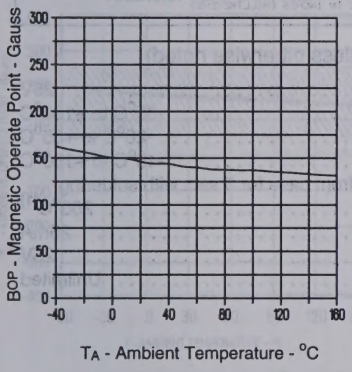
# Types OHN3040U, OHS3040U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 V, $T_A$ = 25°C unless otherwise noted)

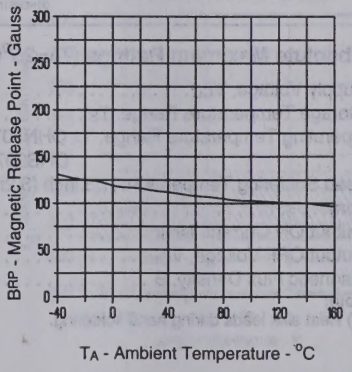
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | | 150 | 200 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | 50 | 115 | | Gauss | |
| $B_H$ | Magnetic Hysteresis | 20 | 35 | | Gauss | |
| $I_{CC}$ | Supply Current | | 4 | 7 | mA | $V_{CC}$ = 24 V, Output Off |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 400 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 20 mA, B ≥ 200 Gauss |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 24 V, $V_{OUT}$ = 24 V, B ≤ 50 Gauss |
| $t_r$ | Output Rise Time | | 0.21 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF |
| $t_f$ | Output Fall Time | | 0.25 | 1.00 | µs | |

## Typical Performance Curves

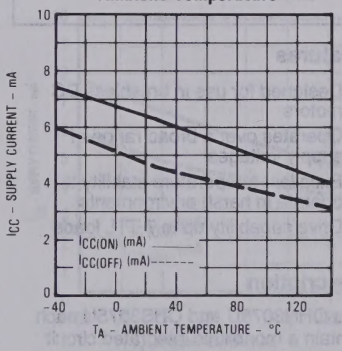
**Magnetic Operate Point vs Ambient Temperature**



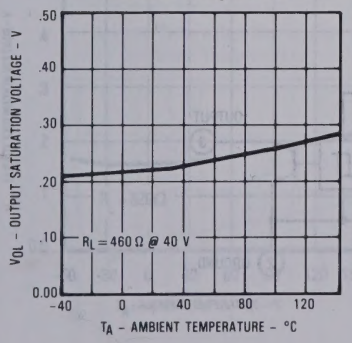

**Magnetic Release Point vs Ambient Temperature**



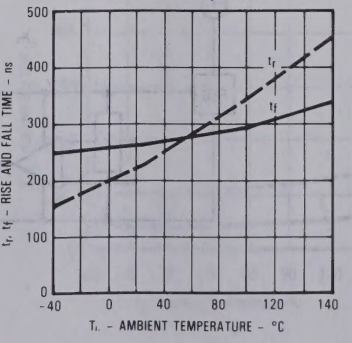

**Supply Current vs Ambient Temperature**



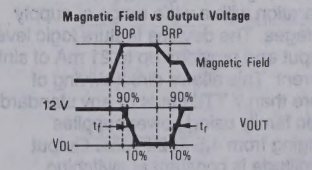

**Output Saturation Voltage vs Ambient Temperature**



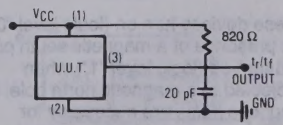

**Rise and Fall Time vs Ambient Temperature**




**Rise and Fall Time Tests**



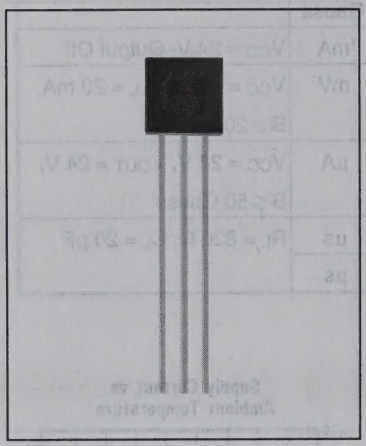

**Rise and Fall Time Test Circuit**

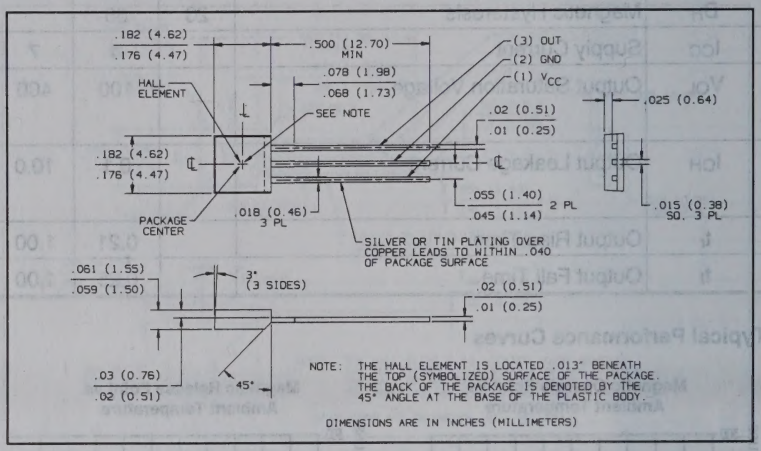



HALL EFFECT SENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Hallogic™ Bipolar Hall Effect Sensors (Latches)
## Types OHN3075U, OHS3075U






### Features

- Designed for use in brushless DC motors
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads

### Description

The OHN3075U and OHS3075U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, a threshold amplifier, and Schmitt trigger on a single Hallogic™ silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 100 kHz.

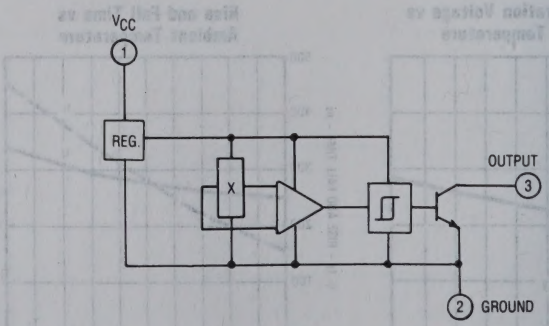
These devices turn on (logic level "0") in the presence of a magnetic south pole and turn off (logic level "1") when subjected to a magnetic north pole. Both magnetic poles are necessary for operation so they are referred to as Bipolar or Latching. This feature makes these sensors ideal for applications in brushless DC motors and for use with multiple pole magnets.

### Absolute Maximum Ratings ($T_A$=25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +160°C |
| Operating Temperature Range, $T_A$ OHN3075U | -20°C to +85°C |
| OHS3075U | -40°C to +150°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



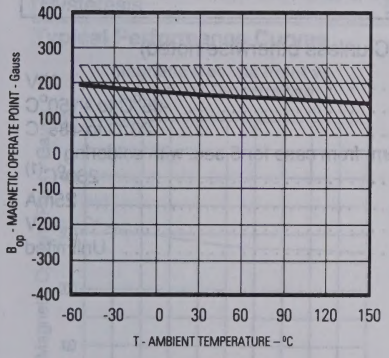
# Types OHN3075U, OHS3075U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 V, $T_A$ = 25°C unless otherwise noted)

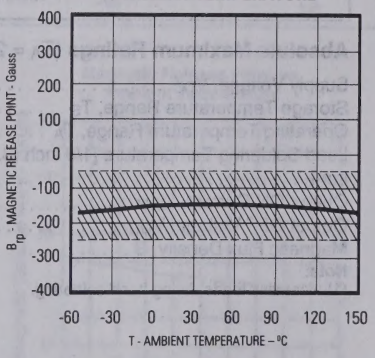
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | 50 | 100 | 250 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | -250 | -100 | -50 | Gauss | |
| $B_H$ | Magnetic Hysteresis | 100 | 200 | 500 | Gauss | |
| $I_{CC}$ | Supply Current | | 4 | 7 | mA | $V_{CC}$ = 24 V, Output Off<br>B ≤ -250 Gauss |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 400 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 20 mA,<br>B ≥ 250 Gauss |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 24 V, $V_{OUT}$ =24 V,<br>B ≤ -250 Gauss |
| $t_r$ | Output Rise Time | | 0.05 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF, |
| $t_f$ | Output Fall Time | | 0.10 | 1.00 | µs | $V_{CC}$ = 12 V |

**Typical Performance Curves**

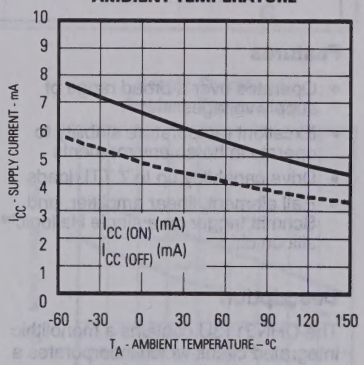
**MAGNETIC OPERATE POINT vs AMBIENT TEMPERATURE**



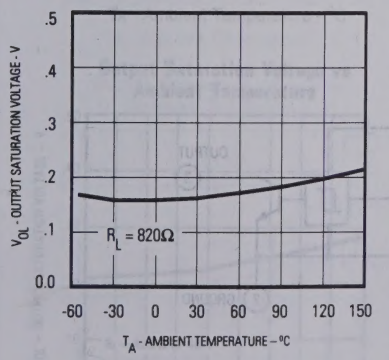

**MAGNETIC RELEASE POINT vs AMBIENT TEMPERATURE**



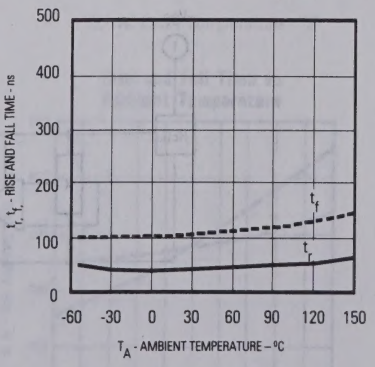

**SUPPLY CURRENT vs AMBIENT TEMPERATURE**




**OUTPUT SATURATION VOLTAGE vs AMBIENT TEMPERATURE**

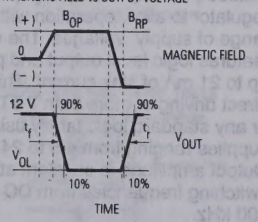



**RISE AND FALL TIME vs AMBIENT TEMPERATURE**

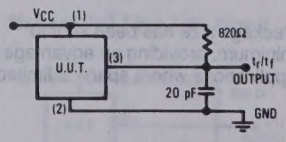



**RISE AND FALL TIME TEST**

MAGNETIC FIELD vs OUTPUT VOLTAGE

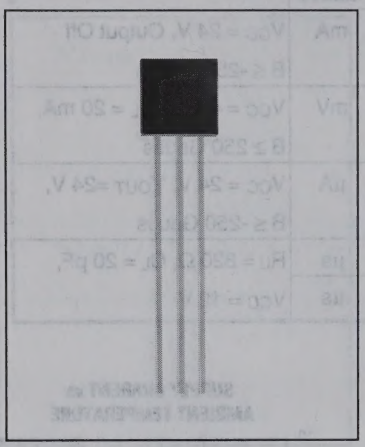


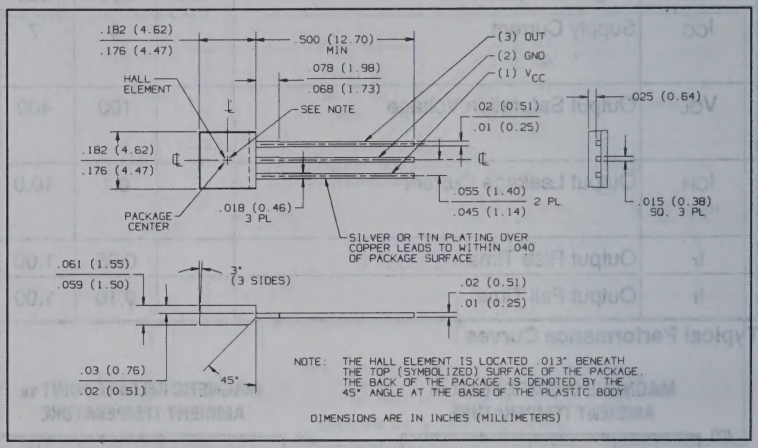

TEST CIRCUIT




HALL EFFECT SENSORS

# Hallogic™ Hall Effect Sensors
## Type OHN3113U






### Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

### Description

The OHN3113U contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

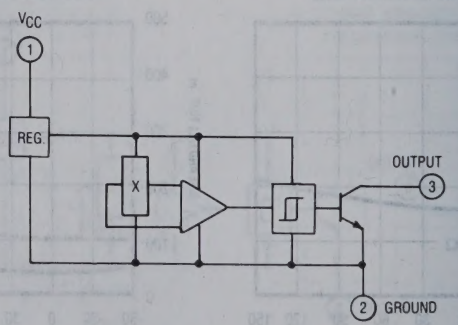
Package size has been kept to minimum, providing an advantage in applications where space is limited.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ | -20°C to +85°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



# Type OHN3113U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 V, $T_A$ = 25°C unless otherwise noted)

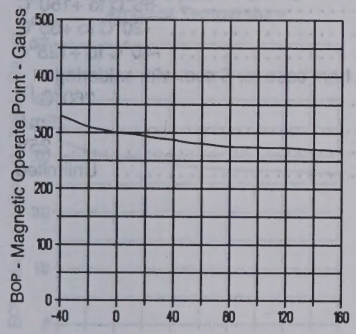
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $I_{CC}$ | Supply Current | | 4 | 7 | mA | $V_{CC}$ = 24 V, Output Off |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 400 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 20 mA, B ≥ 450 Gauss |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 4.5 V, $V_{OUT}$ = 24 V, B ≤ 30 Gauss |
| $t_r$ | Output Rise Time | | 0.21 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF |
| $t_f$ | Output Fall Time | | 0.25 | 1.00 | µs | |

**Magnetic Characteristics**

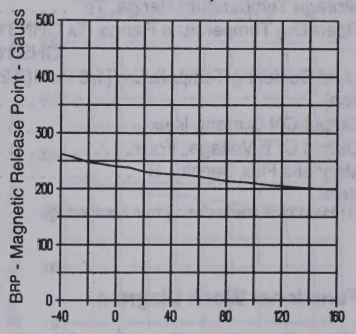
| | | $T_A$ = 25°C | | $T_A$ = -20°C to 85°C | | |
|---|---|---|---|---|---|---|
| CHARACTERISTICS | SYMBOL | MIN | MAX | MIN | MAX | UNITS |
| Operate Point | $B_{OP}$ | | 450 | | 510 | G |
| Release Point | $B_{RP}$ | 30 | | 20 | | G |
| Hysteresis | $B_H$ | 20 | | 10 | | G |

**Typical Performance Curves**

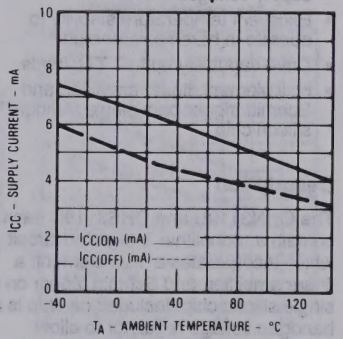
Magnetic Operate Point vs Ambient Temperature



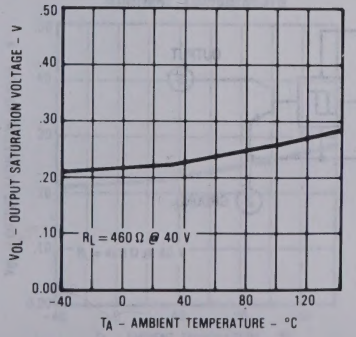

Magnetic Release Point vs Ambient Temperature



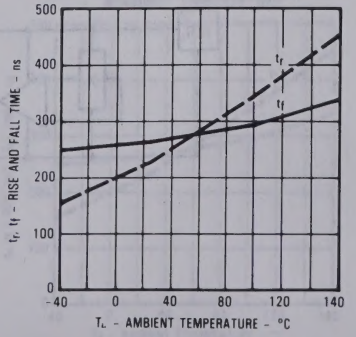

Supply Current vs Ambient Temperature



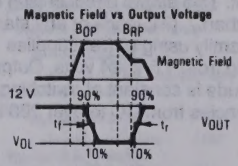

Output Saturation Voltage vs Ambient Temperature



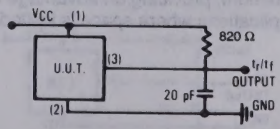

Rise and Fall Time vs Ambient Temperature




Rise and Fall Time Tests




Rise and Fall Time Test Circuit

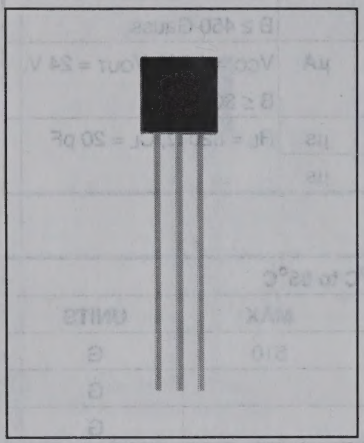


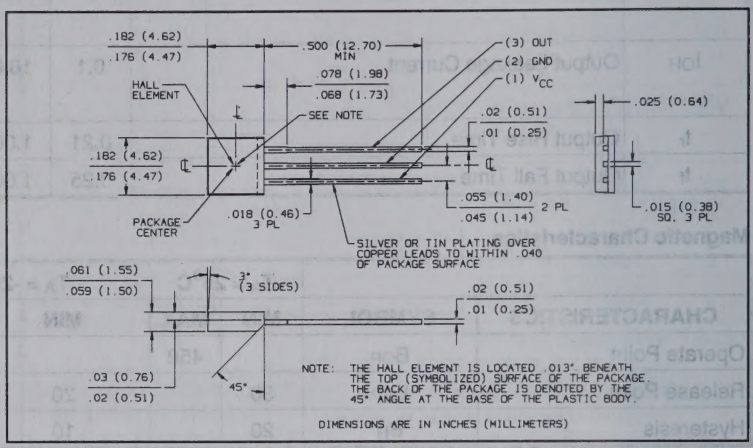



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Hallogic™ Hall Effect Sensors
## Types OHN3119U, OHS3119U






### Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

### Description

The OHN3119U and OHS3119U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

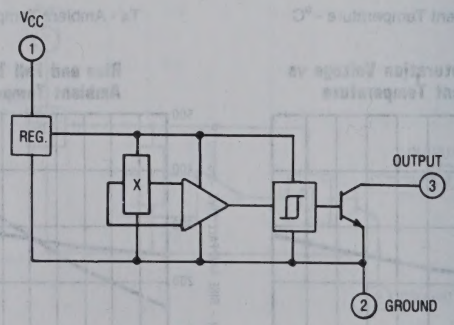
Package size has been kept to minimum, providing an advantage in applications where space is limited.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ OHN3119U | -20°C to +85°C |
| OHS3119U | -40°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C (1) |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



# Types OHN3119U, OHS3119U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 V, $T_A$ = 25°C unless otherwise noted)

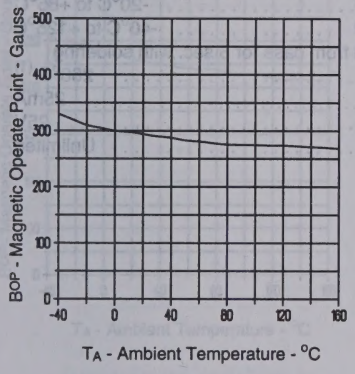
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $I_{CC}$ | Supply Current | | 4 | 7 | mA | $V_{CC}$ = 24 V, Output Off |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 400 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 20 mA, B ≥ 500 Gauss |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 4.5 V, $V_{OUT}$ = 24 V, B ≤ 50 Gauss |
| $t_r$ | Output Rise Time | | 0.21 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF |
| $t_f$ | Output Fall Time | | 0.25 | 1.00 | µs | |

**Magnetic Characteristics**

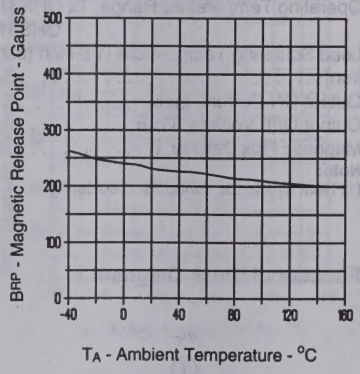
| | | $T_A$ = 25°c | | $T_A$ = -20°C to 85°C | | $T_A$ = -40°C to 125°C | | |
|---|---|---|---|---|---|---|---|---|
| CHARACTERISTICS | SYMBOL | MIN | MAX | MIN | MAX | MIN | MAX | UNITS |
| Operate Point | $B_{OP}$ | 175 | 500 | 100 | 545 | 45 | 575 | G |
| Release Point | $B_{RP}$ | 125 | 450 | 50 | 495 | 25 | 555 | G |
| Hysteresis | $B_H$ | 50 | | 50 | | 20 | | G |

**Typical Performance Curves**

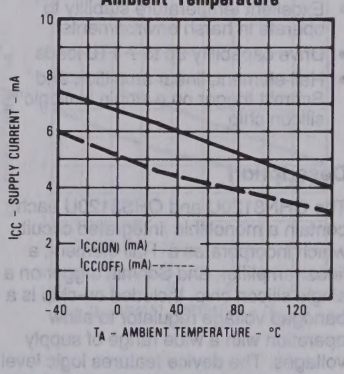
Magnetic Operate Point vs Ambient Temperature



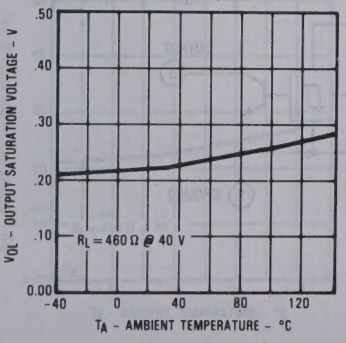

Magnetic Release Point vs Ambient Temperature



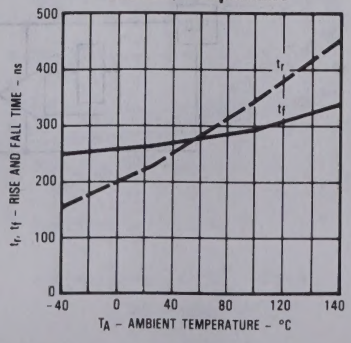

Supply Current vs Ambient Temperature



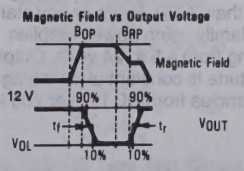

Output Saturation Voltage vs Ambient Temperature



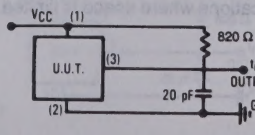

Rise and Fall Time vs Ambient Temperature




Rise and Fall Time Tests




Rise and Fall Time Test Circuit

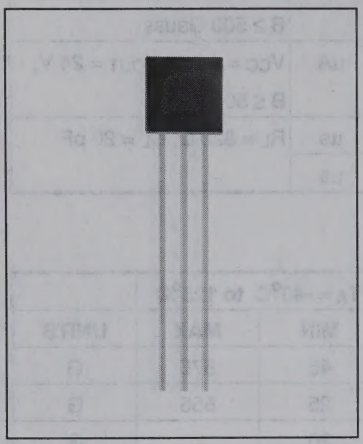


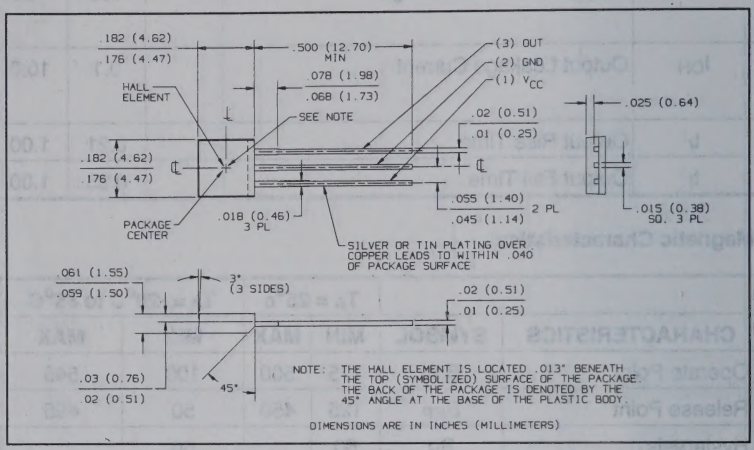



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Hallogic™ Hall Effect Sensors
## Types OHN3120U, OHS3120U






### Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

### Description

The OHN3120U and OHS3120U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

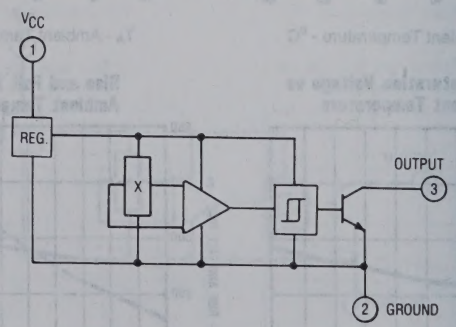
Package size has been kept to minimum, providing an advantage in applications where space is limited.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ OHN3120U | -20°C to +85°C |
| OHS3120U | -40°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C (1) |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



# Types OHN3120U, OHS3120U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 V, $T_A$ = 25°C unless otherwise noted)

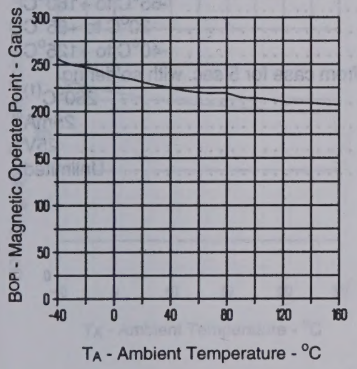
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $I_{CC}$ | Supply Current | | 4 | 7 | mA | $V_{CC}$ = 24 V, Output Off |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 400 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 20 mA, B ≥ 350 Gauss |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 4.5 V, $V_{OUT}$ = 24 V, B ≤ 50 Gauss |
| $t_r$ | Output Rise Time | | 0.21 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF |
| $t_f$ | Output Fall Time | | 0.25 | 1.00 | µs | |

**Magnetic Characteristics**

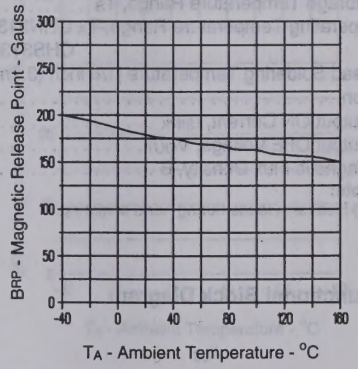
| | | $T_A$ = 25°C | | $T_A$ = -20°C to 85°C | | $T_A$ = -40°C to 125°C | | |
|---|---|---|---|---|---|---|---|---|
| CHARACTERISTICS | SYMBOL | MIN | MAX | MIN | MAX | MIN | MAX | UNITS |
| Operate Point | $B_{OP}$ | 70 | 350 | 70 | 425 | 35 | 450 | G |
| Release Point | $B_{RP}$ | 50 | 330 | 50 | 405 | 25 | 430 | G |
| Hysteresis | $B_H$ | 20 | | 20 | | 20 | | G |

**Typical Performance Curves**

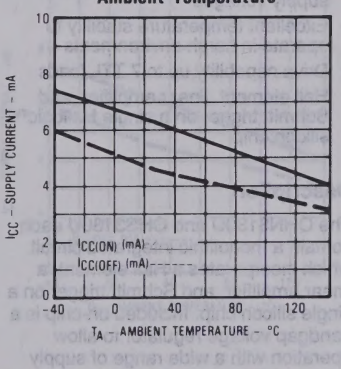
Magnetic Operate Point vs Ambient Temperature



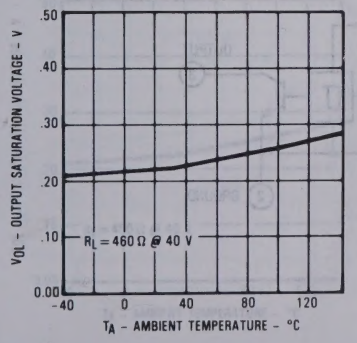

Magnetic Release Point vs Ambient Temperature



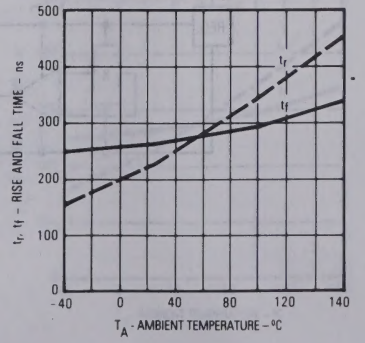

Supply Current vs Ambient Temperature



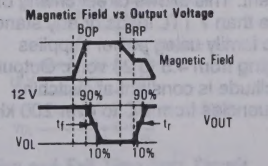

Output Saturation Voltage vs Ambient Temperature



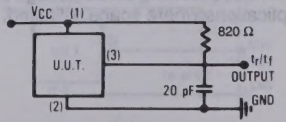

Rise and Fall Time vs Ambient Temperature




Rise and Fall Time Tests



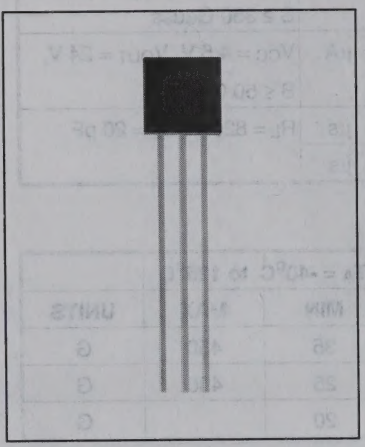

Rise and Fall Time Test Circuit

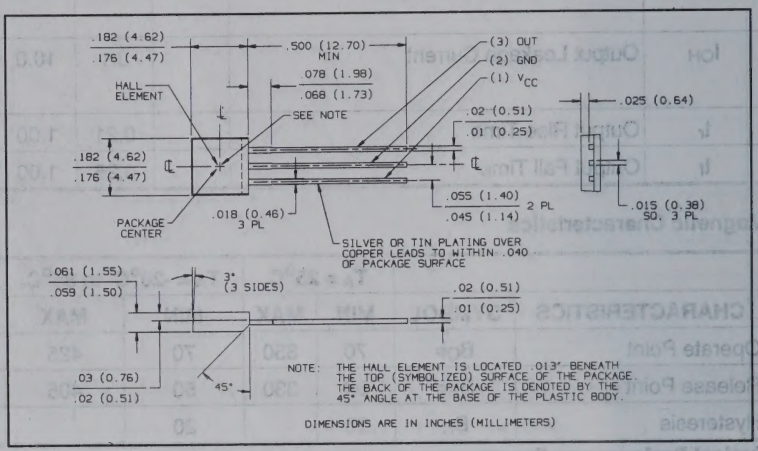



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Hallogic™ Hall Effect Sensors
## Types OHN3130U, OHS3130U






### Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

### Description

The OHN3130U and OHS3130U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

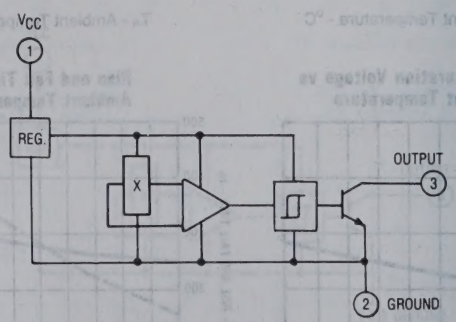
Package size has been kept to minimum, providing an advantage in applications where space is limited.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +160°C |
| Operating Temperature Range, $T_A$ OHN3130U | -20°C to +85°C |
| OHS3130U | -40°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



# Types OHN3130U, OHS3130U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 V, $T_A$ = 25°C unless otherwise noted)

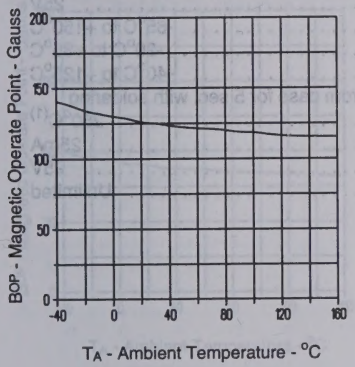
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $I_{CC}$ | Supply Current | | 4 | 7 | mA | $V_{CC}$ = 24 V, Output Off |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 400 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 20 mA, B ≥ 200 Gauss |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 4.5 V, $V_{OUT}$=24 V, B ≤ -150 Gauss |
| $t_r$ | Output Rise Time | | 0.21 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF |
| $t_f$ | Output Fall Time | | 0.25 | 1.00 | µs | |

**Magnetic Characteristics**

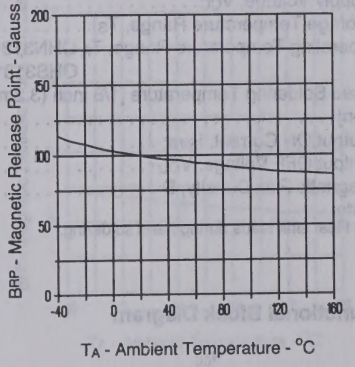
| | | $T_A$ = 25°C | | $T_A$ = -20°C to 85°C | | $T_A$ = -40°C to 125°C | | |
|---|---|---|---|---|---|---|---|---|
| CHARACTERISTICS | SYMBOL | MIN | MAX | MIN | MAX | MIN | MAX | UNITS |
| Operate Point | $B_{OP}$ | | 150 | | 175 | | 200 | G |
| Release Point | $B_{RP}$ | -150 | | -175 | | -200 | | G |
| Hysteresis | $B_H$ | 20 | | 20 | | 20 | | G |

**Typical Performance Curves**

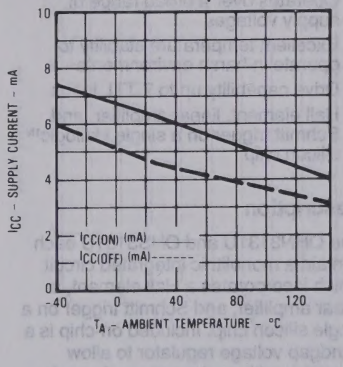
Magnetic Operate Point vs Ambient Temperature



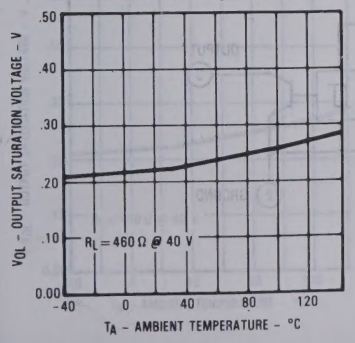

Magnetic Release Point vs Ambient Temperature



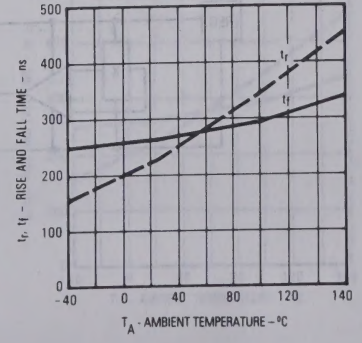

Supply Current vs Ambient Temperature



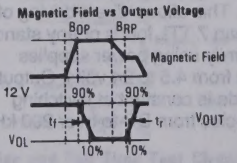

Output Saturation Voltage vs Ambient Temperature



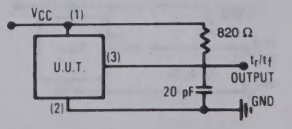

Rise and Fall Time vs Ambient Temperature




Rise and Fall Time Tests




Rise and Fall Time Test Circuit

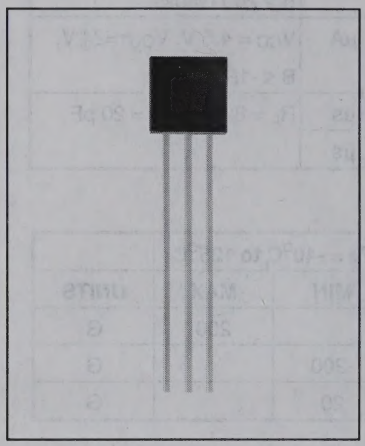


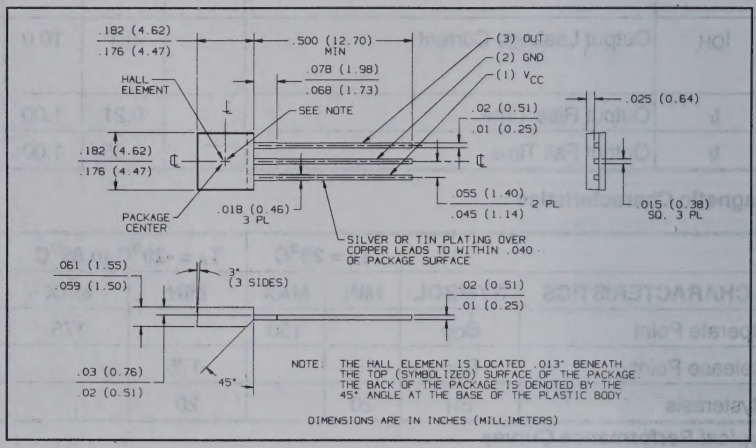



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Ultra Sensitive Hallogic™ Hall Effect Sensors
## Types OHN3131U, OHS3131U






### Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

### Description

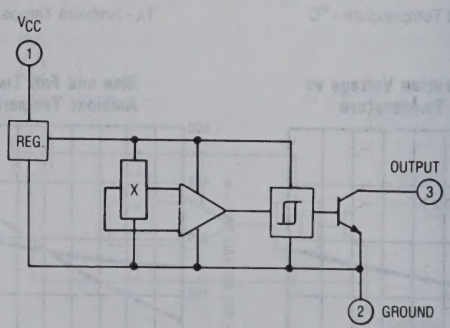
The OHN3131U and OHS3131U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ OHN3131U | -20°C to +85°C |
| OHS3131U | -40°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



# Types OHN3131U, OHS3131U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 V, $T_A$ = 25°C unless otherwise noted)

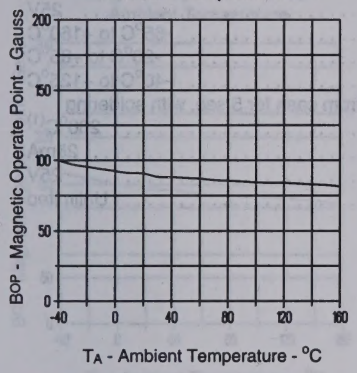
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $I_{CC}$ | Supply Current | | 4.0 | 7.0 | mA | $V_{CC}$ = 24 V, Output Off |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 400 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 20 mA<br>B ≥ 95 Gauss |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 24 V, $V_{OUT}$ = 24 V<br>B ≤ -95 Gauss |
| $t_r$ | Output Rise Time | | 0.21 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF, |
| $t_f$ | Output Fall Time | | 0.25 | 1.00 | µs | $V_{CC}$ = 12.0 V |

**Magnetic Characteristics**

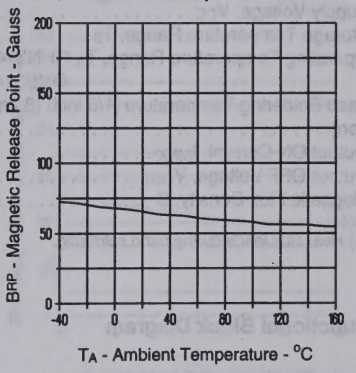
| | | $T_A$ = 25°C | | $T_A$ = -20°C to 85°C | | $T_A$ = -40°C to 125°C | | |
|---|---|---|---|---|---|---|---|---|
| CHARACTERISTICS | SYMBOL | MIN | MAX | MIN | MAX | MIN | MAX | UNITS |
| Operate Point | $B_{OP}$ | -75 | 95 | -75 | 95 | -115 | 135 | G |
| Release Point | $B_{RP}$ | -95 | 85 | -95 | 85 | -135 | 125 | G |
| Hysteresis | $B_H$ | 10 | | 10 | | 10 | | G |

**Typical Performance Curves**

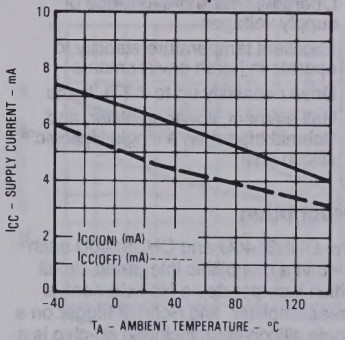
Magnetic Operate Point vs Ambient Temperature



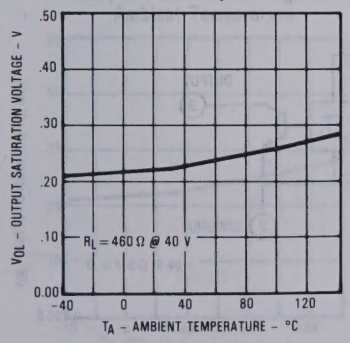

Magnetic Release Point vs Ambient Temperature



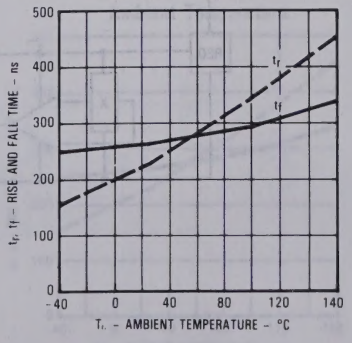

Supply Current vs Ambient Temperature



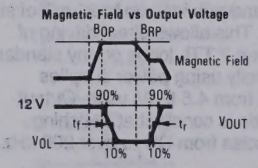

Output Saturation Voltage vs Ambient Temperature



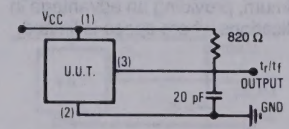

Rise and Fall Time vs Ambient Temperature




Rise and Fall Time Tests




Rise and Fall Time Test Circuit

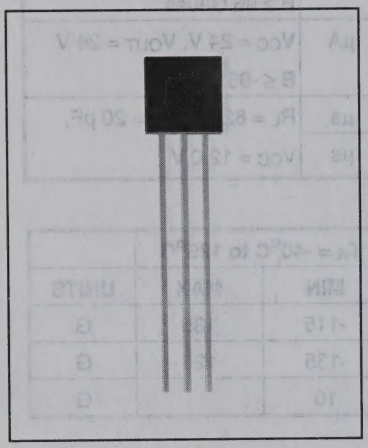


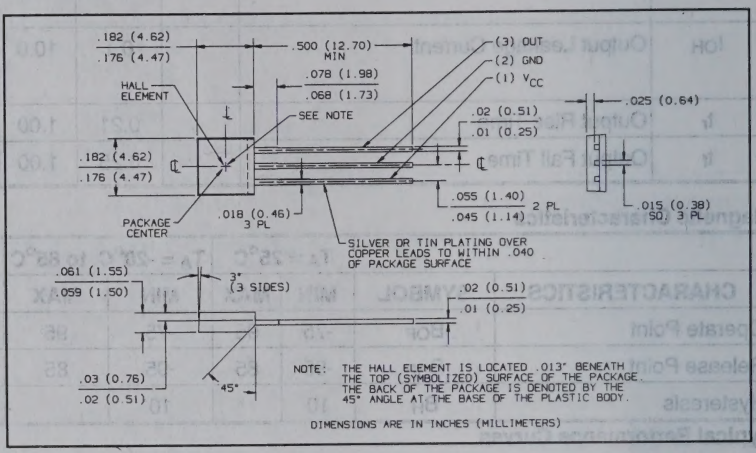



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Hallogic™ Hall Effect Sensors
## Types OHN3140U, OHS3140U






### Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

### Description

The OHN3140U and OHS3140U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

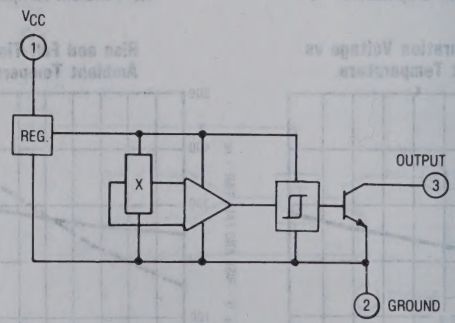
Package size has been kept to minimum, providing an advantage in applications where space is limited.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +160°C |
| Operating Temperature Range, $T_A$ OHN3140U | -20°C to +85°C |
| OHS3140U | -40°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



# Types OHN3140U, OHS3140U

**Electrical Characteristics** ($V_{CC}$ = 4.5V to 24V, $T_A$ = 25°C unless otherwise noted)

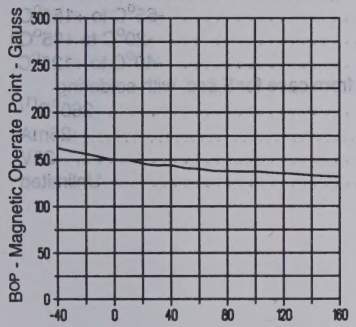
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $I_{CC}$ | Supply Current | | 4 | 7 | mA | $V_{CC}$ = 24 V, Output Off |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 400 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 20 mA, B ≥ 200 Gauss |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 4.5 V, $V_{OUT}$ = 24 V, B ≤ 50 Gauss |
| $t_r$ | Output Rise Time | | 0.21 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF |
| $t_f$ | Output Fall Time | | 0.25 | 1.00 | µs | |

**Magnetic Characteristics**

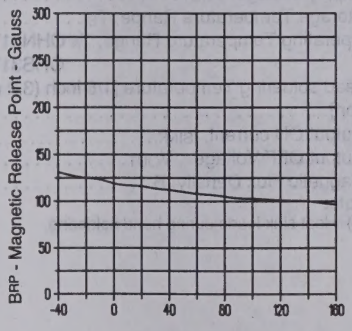
| | | $T_A$ = 25°C | | $T_A$ = -20°C to 85°C | | $T_A$ = -40°C to 125°C | | |
|---|---|---|---|---|---|---|---|---|
| CHARACTERISTICS | SYMBOL | MIN | MAX | MIN | MAX | MIN | MAX | UNITS |
| Operate Point | $B_{OP}$ | 70 | 200 | 45 | 260 | 45 | 270 | G |
| Release Point | $B_{RP}$ | 50 | 180 | 25 | 240 | 25 | 250 | G |
| Hysteresis | $B_H$ | 20 | | 20 | | 20 | | G |

**Typical Performance Curves**

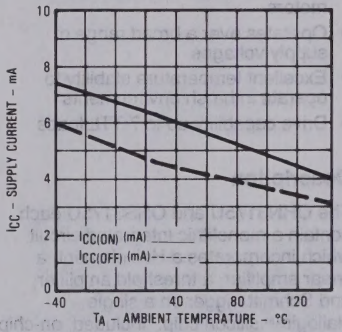
Magnetic Operate Point vs Ambient Temperature



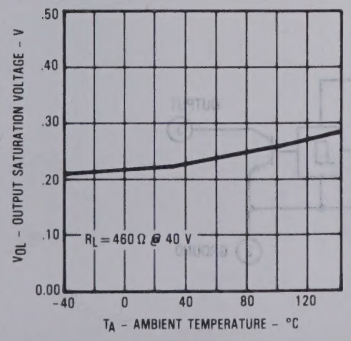

Magnetic Release Point vs



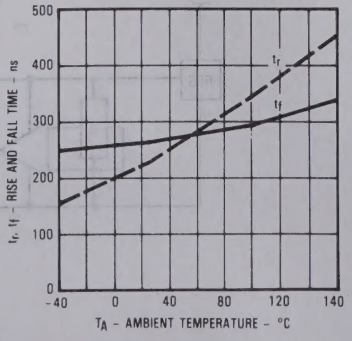

Supply Current vs Ambient Temperature



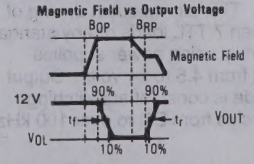

Output Saturation Voltage vs Ambient Temperature



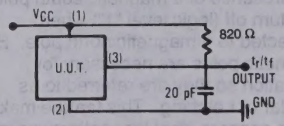

Rise and Fall Time vs Ambient Temperature




Rise and Fall Time Tests



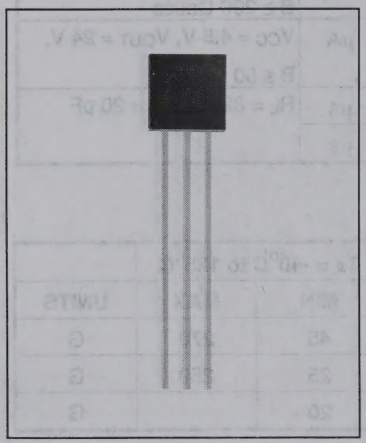

Rise and Fall Time Test Circuit

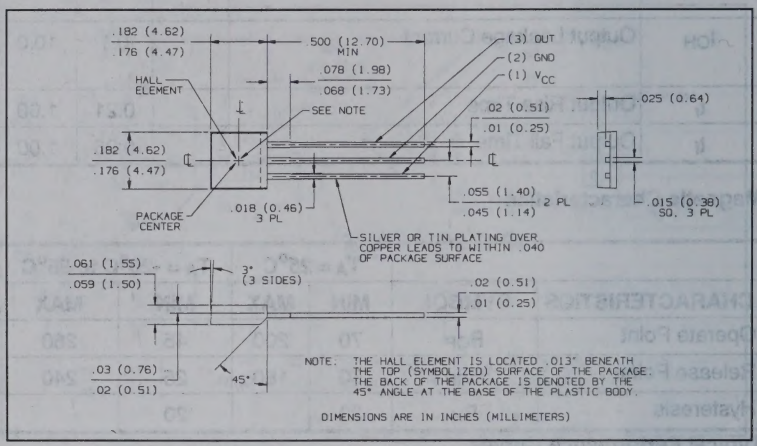





Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Hallogic™ Bipolar Hall Effect Sensors (Latches)
## Types OHN3175U, OHS3175U






### Features

- Designed for use in brushless DC motors
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads

### Description

The OHN3175U and OHS3175U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, a threshold amplifier, and Schmitt trigger on a single Hallogic™ silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 100 kHz.

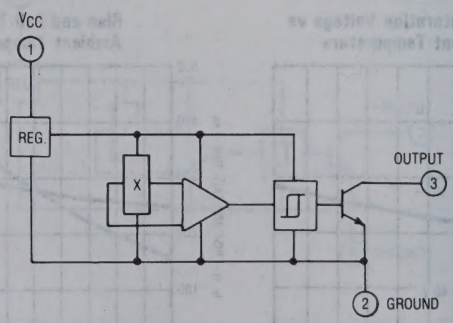
These devices turn on (logic level "0") in the presence of a magnetic south pole and turn off (logic level "1") when subjected to a magnetic north pole. Both magnetic poles are necessary for operation so they are referred to as Bipolar or Latching. This feature makes these sensors ideal for applications in brushless DC motors and for use with multiple pole magnets.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ OHN3175U | -20°C to +85°C |
| OHS3175U | -40°C to +125°C |
| Lead soldering Temperature [1/8 inch (3.2 mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Output ON current, $I_{SINK}$ | 25mA |
| Output OFF Voltage , $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



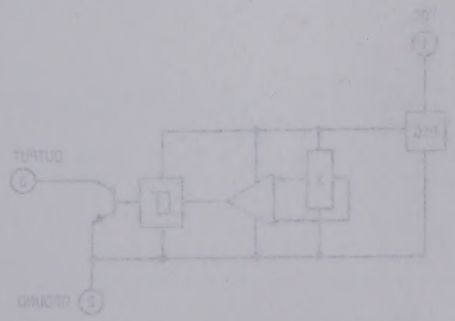
# Types OHN3175U, OHS3175U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 V, $T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $I_{CC}$ | Supply Current | | 4 | 7 | mA | $V_{CC}$ = 24 V, Output Off |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 400 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 20 mA, B ≥ 200 Gauss |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 4.5 V, $V_{OUT}$ = 24 V, B ≤ -250 Gauss |
| $t_r$ | Output Rise Time | | 0.05 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF |
| $t_f$ | Output Fall Time | | 0.10 | 1.00 | µs | |

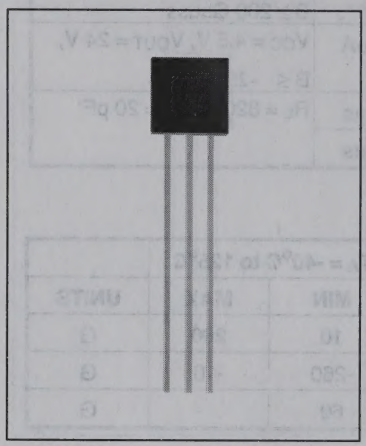
**Magnetic Characteristics**

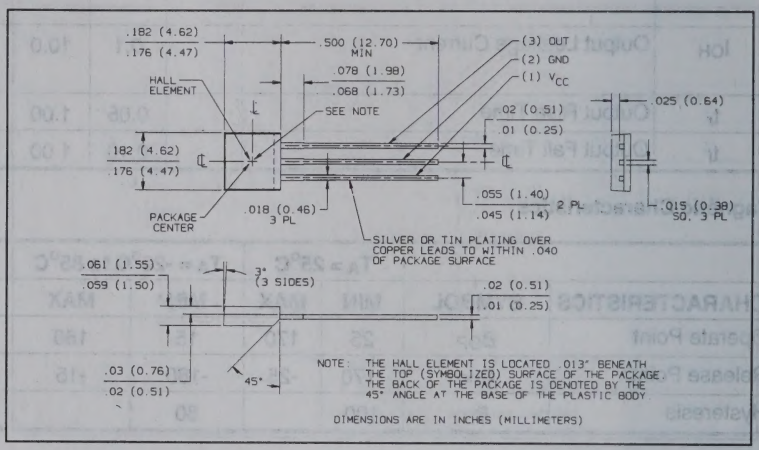
| | | $T_A$ = 25°C | | $T_A$ = -20°C to 85°C | | $T_A$ = -40°C to 125°C | | |
|---|---|---|---|---|---|---|---|---|
| CHARACTERISTICS | SYMBOL | MIN | MAX | MIN | MAX | MIN | MAX | UNITS |
| Operate Point | $B_{OP}$ | 25 | 170 | 15 | 180 | 10 | 260 | G |
| Release Point | $B_{RP}$ | -170 | -25 | -180 | -15 | -260 | -10 | G |
| Hysteresis | $B_H$ | 100 | | 80 | | 60 | | G |



HALL EFFECT SENSORS

# Hallogic™ Bipolar Hall Effect Sensors (Latches)
## Types OHN3177U, OHS3177U






### Features

- Designed for use in brushless DC motors
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads

### Description

The OHN3177U and OHS3177U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, a threshold amplifier, and Schmitt trigger on a single Hallogic™ silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 100 kHz.

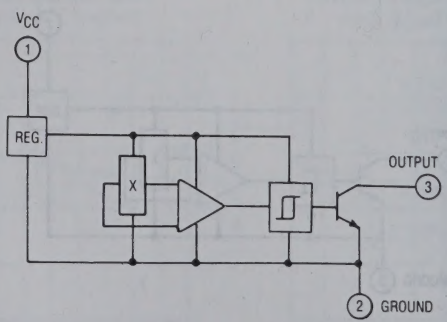
These devices turn on (logic level "0") in the presence of a magnetic south pole and turn off (logic level "1") when subjected to a magnetic north pole. Both magnetic poles are necessary for operation so they are referred to as Bipolar or Latching. This feature makes these sensors ideal for applications in brushless DC motors and for use with multiple pole magnets.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, Ts | -65°C to +160°C |
| Operating Temperature Range, $T_A$ OHN3177U | -20°C to +85°C |
| OHS3177U | -40°C to +125°C |
| Lead soldering Temperature [1/8 inch (3.2 mm) from case for 5 sec. with soldering iron] | 260°C(1) |
| Output ON current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

**Note:**
(1) Heat sink leads during hand soldering.

### Functional Block Diagram



# Types OHN3177U, OHS3177U

**Electrical Characteristics** ($V_{CC}$ = 4.5 V to 24 V, $T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $I_{CC}$ | Supply Current | | 4 | 7 | mA | $V_{CC}$ = 24 V, Output Off |
| $V_{OL}$ | Output Saturation Voltage | | 100 | 400 | mV | $V_{CC}$ = 4.5 V, $I_{OL}$ = 20 mA, B ≥ 200 Gauss |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 4.5 V, $V_{OUT}$ = 24 V, B ≤ -150 Gauss |
| $t_r$ | Output Rise Time | | 0.05 | 1.00 | µs | $R_L$ = 820 Ω, $C_L$ = 20 pF |
| $t_f$ | Output Fall Time | | 0.10 | 1.00 | µs | |

**Magnetic Characteristics**

| | | $T_A$ = 25°C | | $T_A$ = -20°C to 85°C | | $T_A$ = -40°C to 125°C | | |
|---|---|---|---|---|---|---|---|---|
| CHARACTERISTICS | SYMBOL | MIN | MAX | MIN | MAX | MIN | MAX | UNITS |
| Operate Point | $B_{OP}$ | 50 | 150 | 25 | 150 | 25 | 200 | G |
| Release Point | $B_{RP}$ | -150 | -50 | -150 | -25 | -200 | -25 | G |
| Hysteresis | $B_H$ | 100 | | 50 | | 50 | | G |



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK TECHNOLOGY, INC.

# REFLECTIVE OBJECT SENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Reflective Assemblies

Reflective assemblies are motion or position sensors that provide non-contact sensing of a reflective surface or a *change* in surface reflectivity. Such an assembly consists of an infrared emitting diode (IRED) and sensor (an NPN silicon phototransistor, photodarlington of Photologic™ ) in the same housing. The emitter and sensor are positioned on the same side of the assembly, facing the surface to be sensed, which can be a major mounting advantage in certain applications.

(Application Bulletin 204, printed in this data book, presents an in-depth discussion of reflective assemblies and possible problems involving mounting configurations, reflective surfaces, and sensing circuits. If you have further questions, please contact your local Optek representative, or Optek Technology, Inc. in Carrollton, Texas.)

An important consideration to keep in mind when using reflective assemblies is that the photosensor will not necessarily "see" infrared radiation in the same way that the human eye sees visible light. For example, a black surface and a white surface may, under certain conditions, have similar reflective properties when illuminated with infrared radiation.

Optek makes two types of reflective assemblies; focused and unfocused.

## Focused Reflective Assemblies

Focused reflective assemblies are best for sensing specular or polished surfaces. They are made from discrete devices with convex lenses (see Figure 1). In such assemblies, the emitter and sensor are mounted on converging optical axes.

For the standard focused type, the on-state collector current, $I_{C(ON)}$, peaks when a reflective surface is placed between 0.100 and 0.200 inches (2.5 to 50. mm) in front of the reflective assembly. $I_{C(ON)}$ is the collector current created by the infrared radiation emitted by the IRED and detected by the photosensor from the reflective surface.

The IRED emits radiation which follows a diverging pattern, not a straight line, through its centerline. The sensor views a converging pattern rather than a straight line through its center.

## Unfocused Reflective Assemblies

Unfocused reflective assemblies are best for sensing diffuse or rough surfaces. They are often manufactured from discrete devices utilizing plano or non-magnifying lenses (see Figure 2). In the standard assembly, the emitter and sensor are usually mounted on parallel optical axes.

For unfocused assemblies, the reflective surface generally must be placed closer to the assembly than when using a focused type. The reason is that $I_{C(ON)}$ peaks when the reflective surface is between 0.040 and 0.080 inches (1.00 to 2.0 mm) from the front of the assembly.

Consideration should be given to possible variations in signal level when designing the use of reflective assemblies. Such variations may occur for a variety of reasons:

- Inconsistency in placement of reflective surfaces, resulting in variation in distance between the surface and the reflective assembly.
- Variations in the reflective surfaces. In some instances, black and white surfaces can exhibit similar reflective properties.
- Using transmissive materials between the reflective assembly and the reflective surface.
- Variations from assembly to assembly. (Especially where the devices are tested to a minimum limit only.)

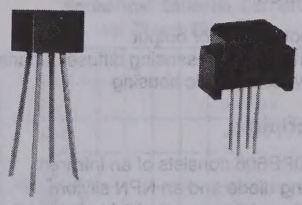
- Variation in size is another potential problem area. An optimum sized reflective surface is one in which no increase in $I_{C(ON)}$ is observed when the surface area is increased.
- Variations in signal level can be observed due to spurious illumination from outside sources.

Optek makes reflective assemblies in a wide variety of sizes and shapes for many different applications. The customer can find suitable reflective assemblies to meet a wide variety of specifications. However, many times designers are faced with conditions that prevent the use of standard reflective assemblies, as specified by the manufacturer. Reflective surfaces may be different than specified and the distance between the reflective surface may be greater or closer than that specified, or cannot be consistently maintained. Various mounting requirements may make tighter control impractical and the contrast ratio may have to be improved. In many of these application-specific situations, Optek can design a custom reflective assembly to meet your needs.

**Figure 1. Focused Reflective Assemblies**

**OPB700, 701** **OPB704** **OPB708, 709**

**Figure 2. Unfocused Reflective Assemblies**



**OPB706, 707** **OPB711,712**

## Applications

Measuring surface roughness.

Sensing the level of liquids.

Detecting variations in surface locations.

Detecting presence or absence of paper in office machines.

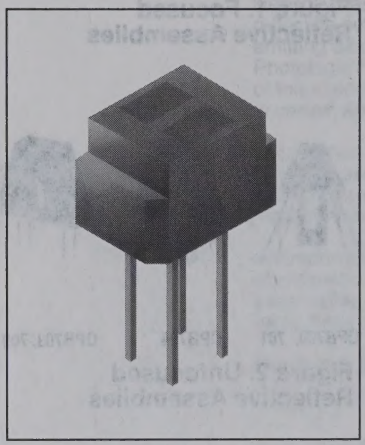
Controlling the shutter and/or flash in sophisticated cameras.

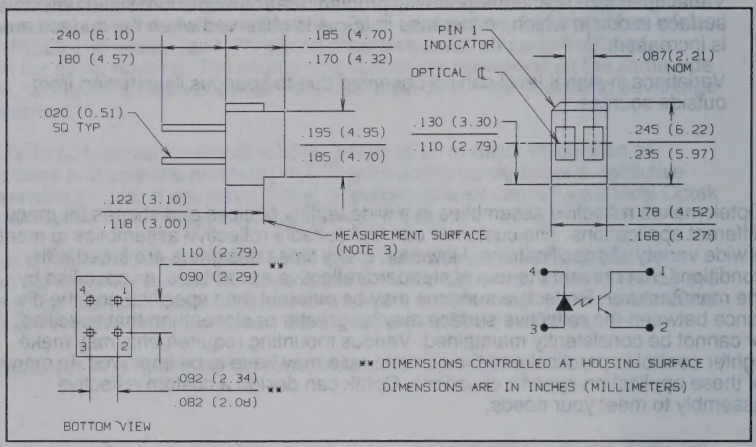
Triggering a high speed print cutting mechanism.

Plus many other applications in industrial controls, surveillance mechanisms, and elsewhere.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Reflective Object Sensors
## Types OPB606A, OPB606B, OPB606C






### Features

- Phototransistor output
- Unfocused for sensing diffuse surface
- Low cost plastic housing

### Description

The OPB606 consists of an infrared emitting diode and an NPN silicon phototransistor mounted "side-by-side" on parallel axes in a black opaque plastic housing. Both the emitting diode and phototransistor are encapsulated in a filtering epoxy to reduce ambient light noise. The phototransistor responds to radiation from the emitter only when a reflective object passes within its field of view.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 75mW(2) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 25mA |
| Power Dissipation | 75mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.25mW/°C above 25°C.
(3) d is the distance from the assembly measurement surface to the reflective surface.
(4) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Off state collector current $I_{C(OFF)}$ is measured with no reflective surface in the optical path.
(6) Lower curve is a calculated worst case and not the conventional - 2σ limit.
(7) All parameters tested using pulse techniques.

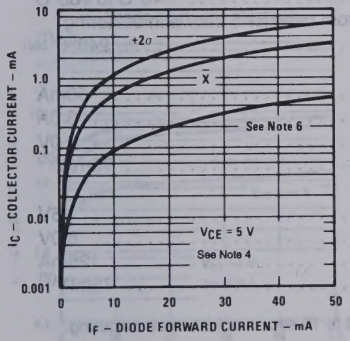
# Types OPB606A, OPB606B, OPB606C

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

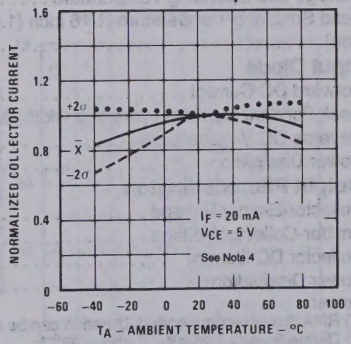
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0 V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_C$ = 100 µA, |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100 µA, |
| $I_{CEO}$ | Collector Dark Current | | | 100 | nA | $V_{CE}$ = 5.0 V, $I_F$ = 0, $E_e$ = ≤ 0.10 µW/cm$^2$ |
| **Combined** | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | OPB606A | 500 | | µA | $V_{CE}$ = 5.0 V, $I_F$ = 20 mA, d = 0.110 in. (2.79 mm) (3)(4) |
| | | OPB606B | 350 | | µA | |
| | | OPB606C | 200 | | µA | |
| $I_{C(OFF)}$ | Off-State Collector Current | | | 200 | nA | $V_{CE}$ = 5.0 V, $I_F$ = 20 mA, (5) |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 0.40 | V | $I_F$ = 20 mA, $I_C$ = 100 µA, d = 0.110 in. (2.79 mm) (3)(4) |

## Typical Performance Curves

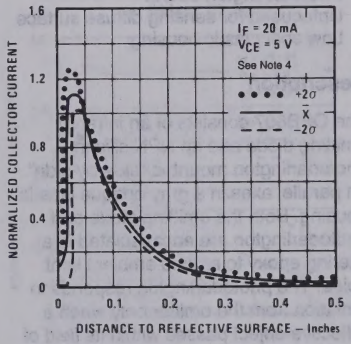
**Collector Current vs. Diode Forward Current**



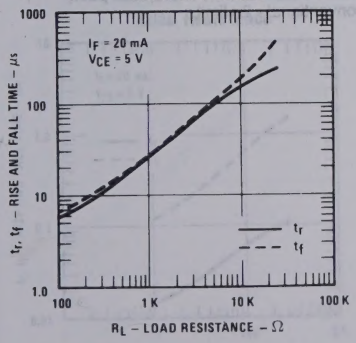

**Normalized Collector Current vs. Ambient Temperature**



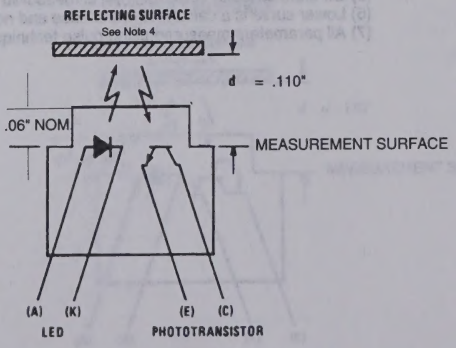

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**

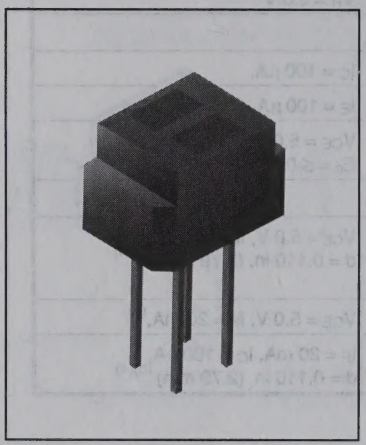


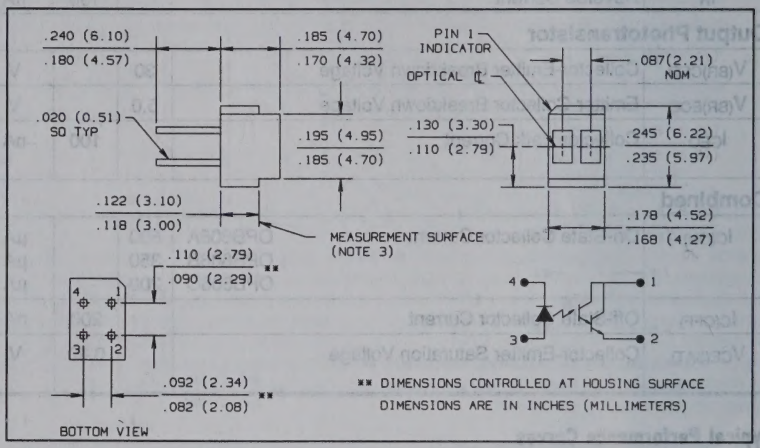

**Test Condition**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Reflective Object Sensors
## Types OPB607A, OPB607B, OPB607C






### Features

- Photodarlington output
- Unfocused for sensing diffuse surface
- Low cost plastic housing

### Description

The OPB607 consists of an infrared emitting diode and an NPN silicon photodarlington mounted "side-by-side" on parallel axes in a gray opaque plastic housing. Both the emitting diode and photodarlington are encapsulated in a filtering epoxy to reduce ambient light noise. The photodarlington responds to radiation from the emitter only when a reflective object passes within its field of view.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Forward DC Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 75mW(2)

**Output Photodarlington**

Collector-Emitter Voltage ..... 15V
Emitter-Collector Voltage ..... 5.0V
Collector DC Current ..... 125mA
Power Dissipation ..... 75mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.25mW/°C above 25°C.
(3) d is the distance from the assembly measurement surface to the reflective surface.
(4) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Off state collector current $I_{C(OFF)}$ is measured with no reflective surface in the optical path.
(6) Lower curve is a calculated worst case and not the conventional - 2σ limit.
(7) All parameters measured using pulse techniques.

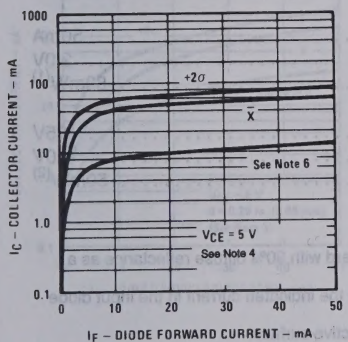
# Types OPB607A, OPB607B, OPB607C

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

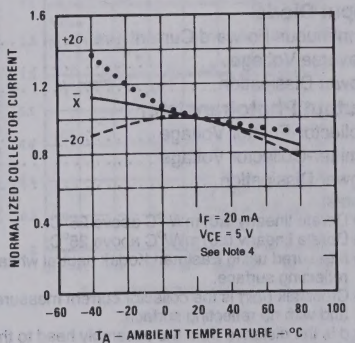
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0 V |
| **Output Photodarlington** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 15 | | V | $I_C$ = 100 µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100 µA |
| $I_{CEO}$ | Collector Dark Current | | | 250 | nA | $V_{CE}$ = 5.0 V, $I_F$ = 0, $E_e$ = ≤ 0.10 µW/cm$^2$ |
| **Combined** | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | OPB607A | 25 | | mA | $V_{CE}$ = 5.0 V, $I_F$ = 20 mA, d = 0.110 in. (2.79 mm)[3][4] |
| | | OPB607B | 17 | | mA | |
| | | OPB607C | 10 | | mA | |
| $I_{C(OFF)}$ | Off-State Collector Current | | | 10 | µA | $V_{CE}$ = 5.0 V, $I_F$ = 20 mA[5] |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 1.10 | V | $I_F$ = 20 mA, $I_C$ = 2 mA, d = 0.110 in. (2.79 mm)[3][4] |

## Typical Performance Curves

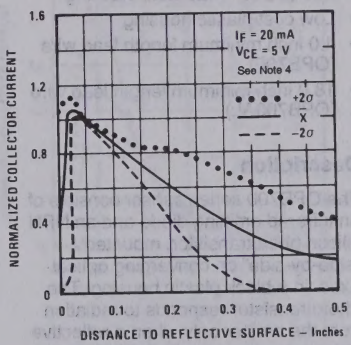
**Collector Current vs. Diode Forward Current**



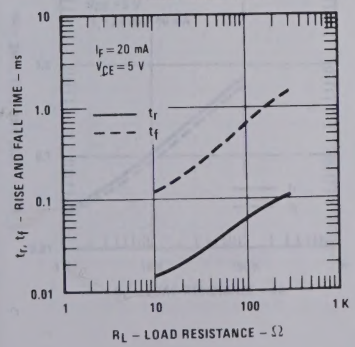

**Normalized Collector Current vs. Ambient Temperature**



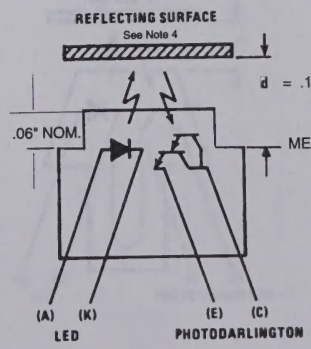

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**

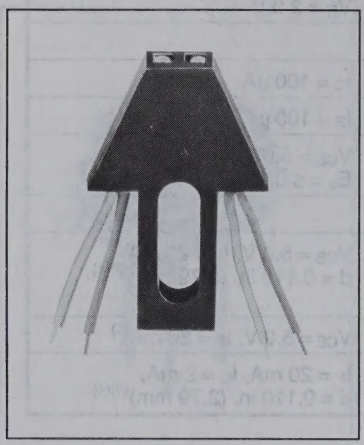


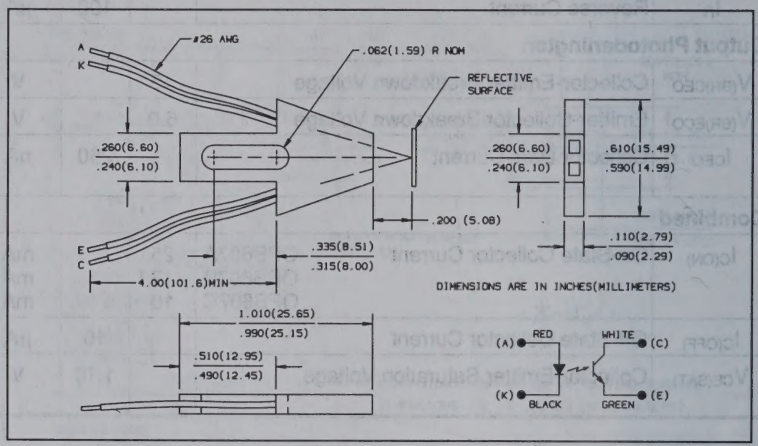

**Test Condition**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Reflective Object Sensor
## Types OPB700, OPB700AL






### Features

- Phototransistor output
- Low profile to facilitate stacking
- Low cost plastic housing
- 4.0 inch minimum length lead wire (OPB700)
- 18.0 inch minimum length lead wire (OPB700AL)

### Description

The OPB700 series sensor consists of an infrared emitting diode and an NPN silicon phototransistor, mounted "side-by-side" on converging optical axes, in a black plastic housing. The phototransistor responds to radiation from the emitter only when a reflective object passes within its field of view.

Leads are #26 AWG, teflon insulation, 4.0" minimum length (OPB700) or 18.0" minimum length (OPB700AL), stripped and tinned.

### Replaces

| | |
|---|---|
| OPB700 | OPB253A |
| OPB700AL | OPB253AL |

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage TemperatureRange | -40°C to +125°C |
| Operating Temperature Range | -40°C to +100°C |
| **Input Diode** | |
| Continuous Forward Current | 50mA |
| Reverse Voltage | 2.0V |
| Power Dissipation | 80mW(1) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 25V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 50mW(2) |

**Notes:**
(1) Derate linearly 1.07mW/°C above 25°C.
(2) Derate linearly 0.67mW/°C above 25°C.
(3) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(4) Crosstalk ($I_{CX}$) is the collector current measured with the indicated current in the input diode and with no reflecting surface.
(5) d is the distance from the assembly head to the reflective surface.
(6) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(7) All parameters tested using pulse technique.

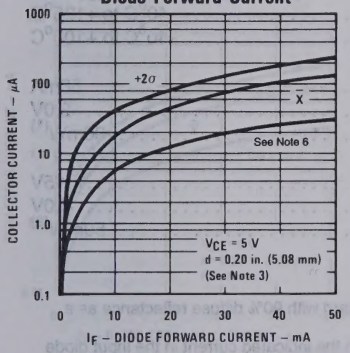
# Type OPB700, OPB700AL

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

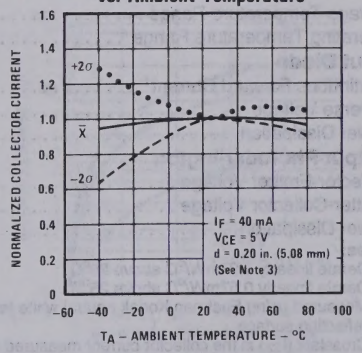
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 50mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 25 | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e \leq 0.10\ \mu W/cm^2$ |
| **Combined** | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 25 | | µA | $V_{CE}$ = 5.0V, $I_F$ = 40mA, d = 0.200 in. (5.08mm)(3)(5) |
| $I_{CX}$ | Crosstalk | | 2.0 | µA | $V_{CE}$ = 5.0V, $I_F$ = 40mA, No Reflecting Surface(4) |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.40 | V | $I_F$ = 40mA, $I_C$ = 10.0µA, d = 0.200 in. (5.08mm)(3)(5) |

## Typical Performance Curves

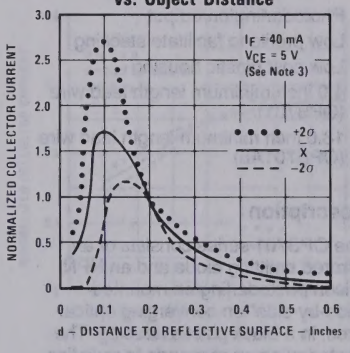
**Collector Current vs. Diode Forward Current**



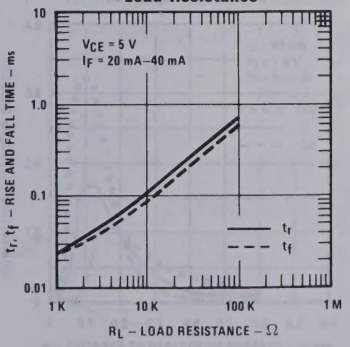

**Normalized Collector Current vs. Ambient Temperature**



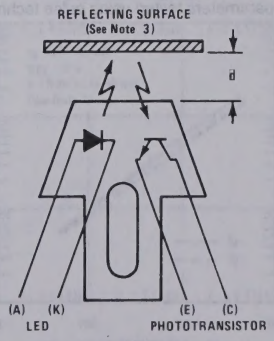

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**



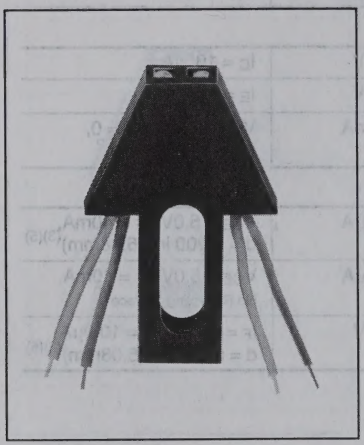

**Test Condition**

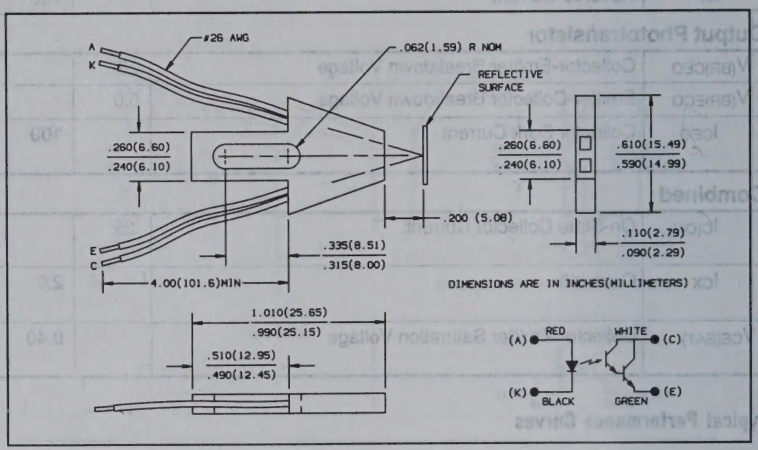



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Reflective Object Sensor
## Type OPB701, OPB701AL






### Features

- Photodarlington output
- Low profile to facilitate stacking
- Low cost plastic housing
- 4.0 inch minimum length lead wire (OPB701)
- 18.0 inch minimum length lead wire (OPB701AL)

### Description

The OPB701 series consists of an infrared emitting diode and an NPN silicon photodarlington mounted "side-by-side" on converging optical axes, in a black plastic housing. The photodarlington responds to radiation from the emitter only when a reflective object passes within its field of view.

Leads are #26 AWG, teflon insulation, 4.0" minimum length (OPB701) or 18.0" minimum length (OPB701AL), stripped and tinned.

### Replaces

| | |
|---|---|
| OPB701 | OPB125A |
| OPB701AL | OPB125AL |

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature Range | -40°C to +125°C |
| Operating Temperature Range | -40°C to +100°C |
| **Input Diode** | |
| Continuous Forward Current | 50mA |
| Reverse Voltage | 2.0V |
| Power Dissipation | 80mW(1) |
| **Output Photodarlington** | |
| Collector-Emitter Voltage | 15V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 50mW(2) |

**Notes:**
(1) Derate linearly 1.07mW/°C above 25°C.
(2) Derate linearly 0.67mW/°C above 25°C.
(3) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(4) Crosstalk (Icx) is the collector current measured with the indicated current in the input diode and with no reflecting surface.
(5) d is the distance from the assembly head to the reflective surface.
(6) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(7) All parameters tested using pulse technique.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

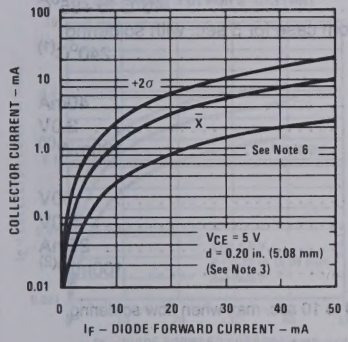
# Type OPB701, OPB701AL

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

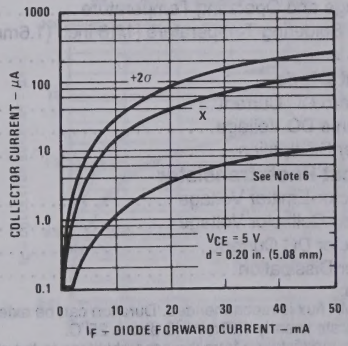
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 50mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Photodarlington** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 15 | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector Dark Current | | 1.00 | µA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e \leq 0.100 \mu W/cm^2$ |
| **Combined** | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 2.0 | | mA | $V_{CE}$ = 5.0V, $I_F$ = 40mA, d = 0.200 in. (5.08mm)(3)(5) |
| $I_{CX}$ | Crosstalk | | 2.0 | µA | $V_{CE}$ = 5.0V, $I_F$ = 40mA, No Reflecting Surface(4) |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 1.10 | V | $I_F$ = 40mA, $I_C$ = 1.0mA, d = 0.200 in. (5.08mm)(3)(5) |

## Typical Performance Curves

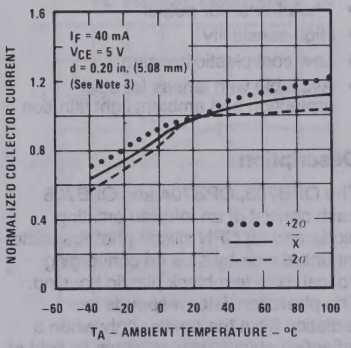
**Reflective Surface Collector Current vs. Diode Forward Current**



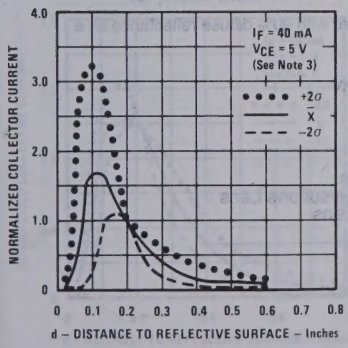

**Diffused Surface Collector Current vs. Diode Forward Current**



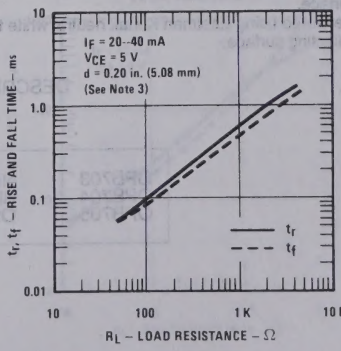

**Normalized Collector Current vs. Ambient Temperature**



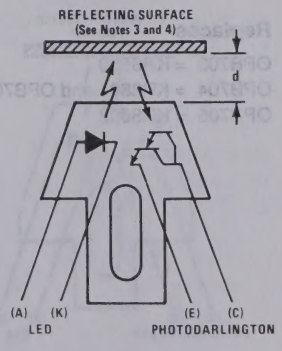

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**

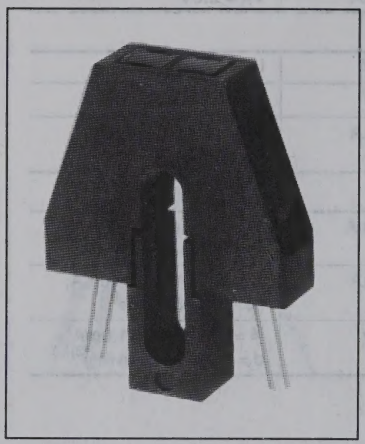


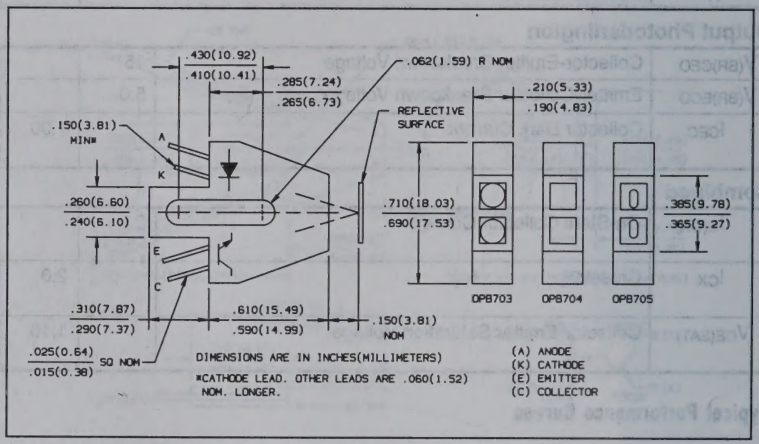

**Test Condition**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Reflective Object Sensors
## Types OPB703, OPB704, OPB705






### Features

- Phototransistor output
- High sensitivity
- Low cost plastic housing
- Available with lenses for dust protection and ambient light filtration

### Description

The OPB703, OPB704 and OPB705 each consist of an infrared emitting diode and an NPN silicon phototransistor mounted side-by-side on converging optical axes in a black plastic housing. The phototransistor responds to radiation from the emitter only when a reflective object passes within its field of view. Various options allow no lens, blue polysulfone lens for dust protection or offset lens for improved resolution.

### Replaces

OPB703 = KR8800
OPB704 = KR8801 and OPB703A
OPB705 = KR8802

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Forward DC Current ..... 40mA
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Collector DC Current ..... 25mA
Power Dissipation ..... 100mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) d is the distance from the assembly face to the reflective surface.
(4) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(5) All parameters tested using pulse technique.
(6) Crosstalk is the photocurrent measured with current to the input diode and no reflecting surface.
(7) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.

DESCRIPTION

| | |
|---|---|
| OPB703 | No Lens |
| OPB704 | Blue Polysulfone Lens |
| OPB705 | Offset Lens |

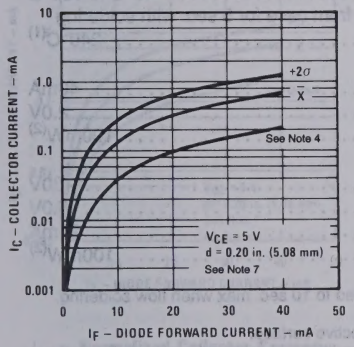
# Types OPB703, OPB704, OPB705

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

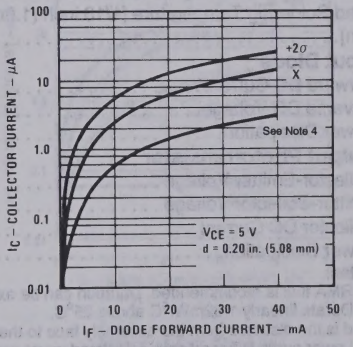
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Output Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F$ = 40 mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0 V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_{CE}$ = 100 µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_{EC}$ = 100 µA |
| $I_{CEO}$ | Collector Dark Current | | | 100 | nA | $V_{CE}$ = 10.0 V, $I_F$ = 0, $E_e$ = 0 |
| **Combined** | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | OPB703 | 200 | | µA | $V_{CE}$ = 5.0 V, $I_F$ = 40 mA, d = 0.15 inch (3.81 mm)(3)(7) |
| | | OPB704 | 200 | | µA | |
| | | OPB705 | 100 | | µA | |
| $I_{CX}$ | Crosstalk | OPB703 | | 20 | µA | $V_{CE}$ = 5.0 V, $I_F$ = 40 mA(6) |
| | | OPB704 | | 20 | µA | |
| | | OPB705 | | 10 | µA | |

## Typical Performance Curves

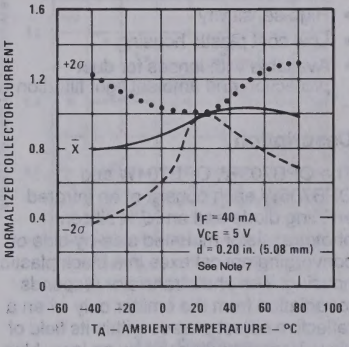
**Reflective Surface Collector Current vs. Diode Forward Current**



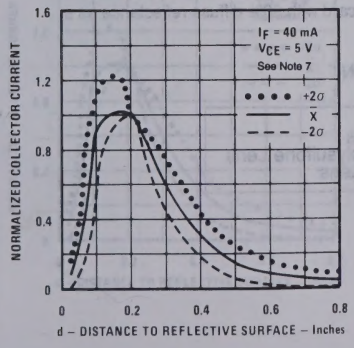

**Diffused Surface Collector Current vs. Diode Forward Current**



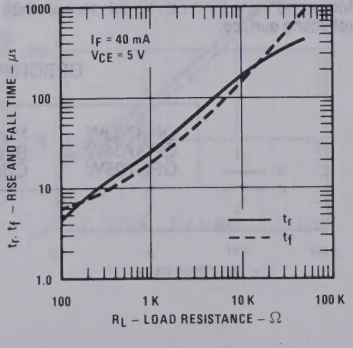

**Normalized Collector Current vs. Ambient Temperature**



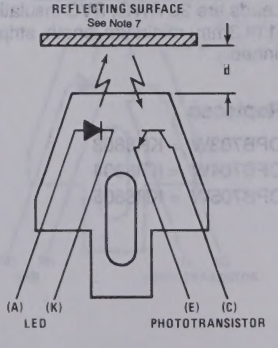

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**



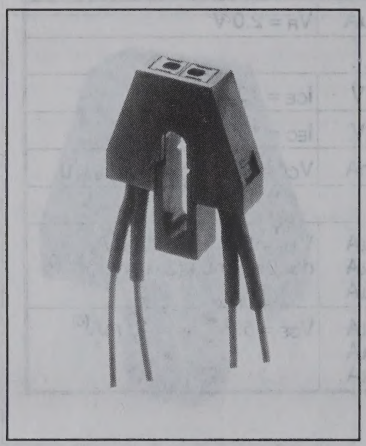

**Test Condition**

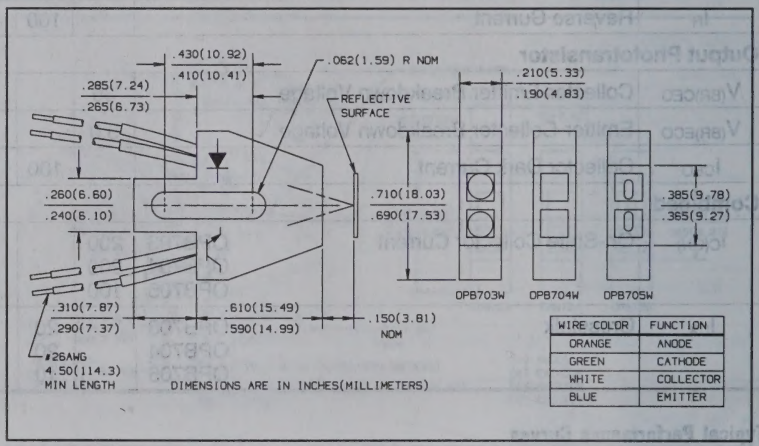



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Reflective Object Sensors
## Types OPB703W, OPB704W, OPB705W






| WIRE COLOR | FUNCTION |
|---|---|
| ORANGE | ANODE |
| GREEN | CATHODE |
| WHITE | COLLECTOR |
| BLUE | EMITTER |

### Features

- Phototransistor output
- High sensitivity
- Low cost plastic housing
- Available with lenses for dust protection and ambient light filtration

### Description

The OPB703W, OPB704W and OPB705W each consist of an infrared emitting diode and an NPN silicon phototransistor mounted side-by-side on converging optical axes in a black plastic housing. The phototransistor responds to radiation from the emitter only when a reflective object passes within its field of view. Various options allow no lens, blue polysulfone lens for dust protection or offset lens for improved resolution.

Leads are 26 AWG, PVC insulation, 4.5" (114.3mm) minimum length, stripped & tinned.

### Replaces

OPB703W = KR8803
OPB704W = KR8804
OPB705W = KR8805

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature ..... -40°C to +80°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Forward DC Current ..... 40mA
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Collector DC Current ..... 25mA
Power Dissipation ..... 100mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.82mW/°C above 25°C.
(3) d is the distance from the assembly face to the reflective surface.
(4) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(5) All parameters tested using pulse technique.
(6) Crosstalk is the photocurrent measured with current to the input diode and no reflecting surface.
(7) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.

| | DESCRIPTION |
|---|---|
| OPB703W | No Lens |
| OPB704W | Blue Polysulfone Lens |
| OPB705W | Offset Lens |

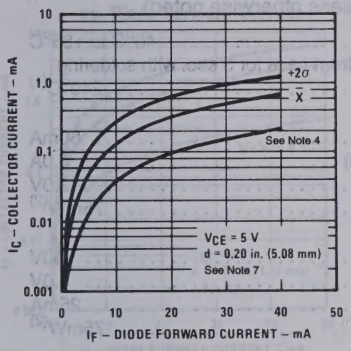
# Types OPB703W, OPB704W, OPB705W

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

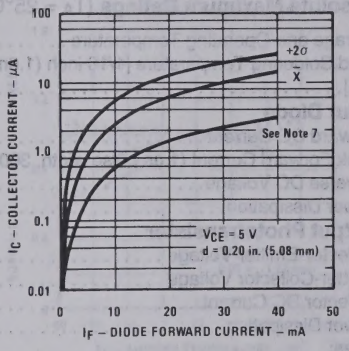
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F$ = 40mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_{CE}$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_{EC}$ = 100µA |
| $I_{CEO}$ | Collector Dark Current | | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Combined** | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | OPB703W | 200 | | µA | $V_{CE}$ = 5.0V, $I_F$ = 40mA, |
| | | OPB704W | 200 | | µA | d = 0.15 in (3.81mm)[3][7] |
| | | OPB705W | 100 | | µA | |
| $I_{CX}$ | Crosstalk | OPB703W | | 20 | µA | $V_{CE}$ = 5.0V, $I_F$ = 40mA[6] |
| | | OPB704W | | 20 | µA | |
| | | OPB705W | | 10 | µA | |

## Typical Performance Curves

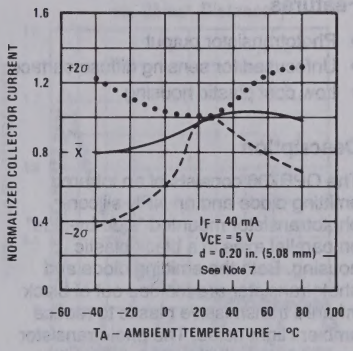
**Reflective Surface Collector Current vs. Diode Forward Current**



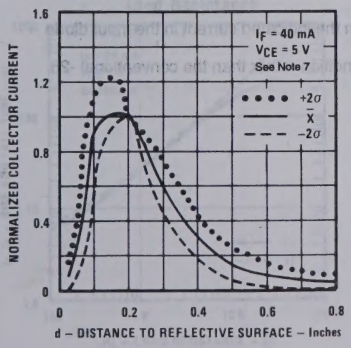

**Diffused Surface Collector Current vs. Diode Forward Current**



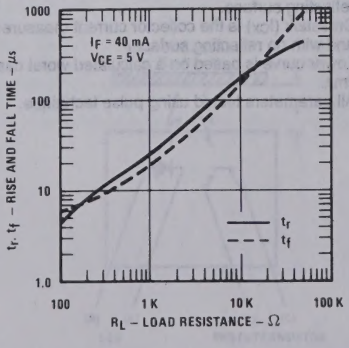

**Normalized Collector Current vs. Ambient Temperature**



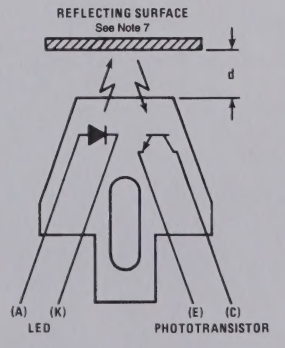

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**

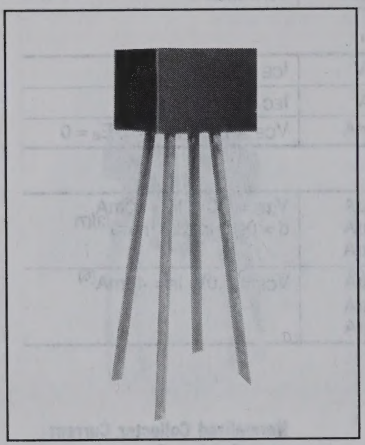


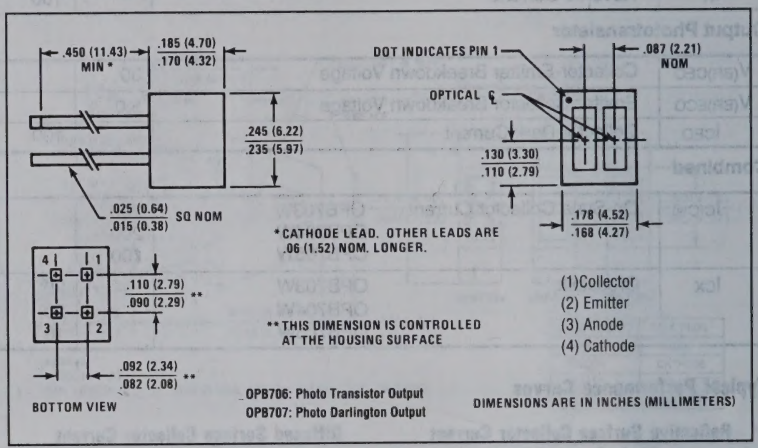

**Test Condition**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Reflective Object Sensors
## Types OPB706A, OPB706B, OPB706C






### Features

- Phototransistor output
- Unfocused for sensing diffuse surface
- Low cost plastic housing

### Description

The OPB706 consists of an infrared emitting diode and an NPN silicon phototransistor mounted "side-by-side" on parallel axes in a black plastic housing. Both the emitting diode and phototransistor are molded out of black infrared transmissive plastic to reduce ambient light noise. The phototransistor responds to radiation from the emitter only when a reflective object passes within its field of view.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Input Diode**

| | |
|---|---|
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 75mW(2) |

**Output Phototransistor**

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 25mA |
| Power Dissipation | 75mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.25mW/°C above 25°C.
(3) d is the distance from the assembly face to the reflective surface.
(4) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Crosstalk ($I_{CX}$) is the collector current measured with the indicated current in the input diode and with no reflecting surface.
(6) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(7) All parameters tested using pulse technique.

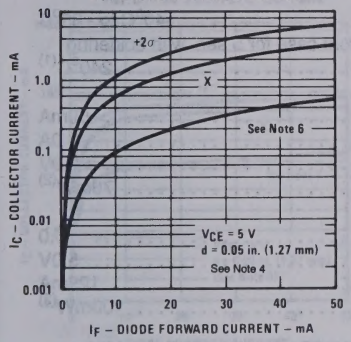
# Types OPB706A, OPB706B, OPB706C

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

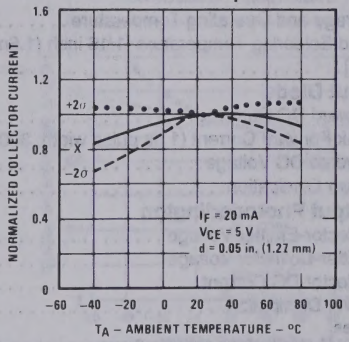
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_C$ = 100µA, |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100µA, |
| $I_{CEO}$ | Collector Dark Current | | | 100 | nA | $V_{CE}$ = 5.0V, $I_F$ = 0, $E_e \leq 0.1\mu W/cm^2$ |
| **Combined** | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | OPB706A<br>OPB706B<br>OPB706C | 500<br>350<br>200 | | µA<br>µA<br>µA | $V_{CE}$ = 5.0V, $I_F$ = 20mA, d = 0.050 in. (1.27mm) (3)(4) |
| $I_{CX}$ | Crosstalk | | | 200 | nA | $V_{CE}$ = 5.0V, $I_F$ = 20mA,(5) |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 0.40 | V | $I_F$ = 20mA, $I_C$ = 100µA, d = 0.050 in. (1.27mm) (3)(4) |

## Typical Performance Curves

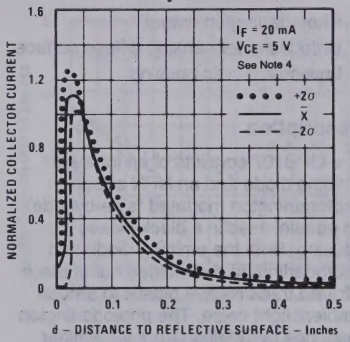
**Collector Current vs. Diode Forward Current**



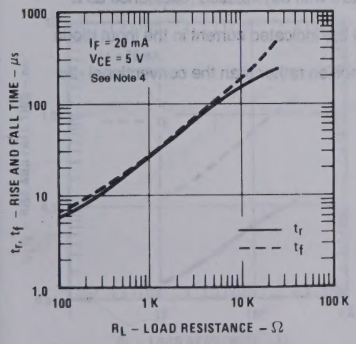

**Normalized Collector Current vs. Ambient Temperature**



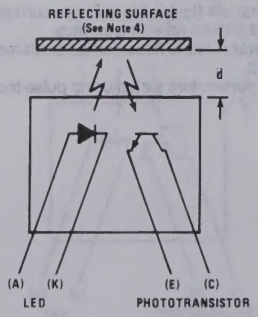

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**



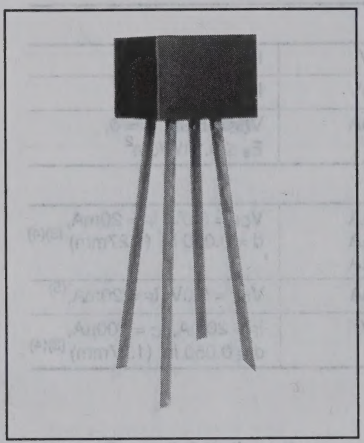

**Test Condition**

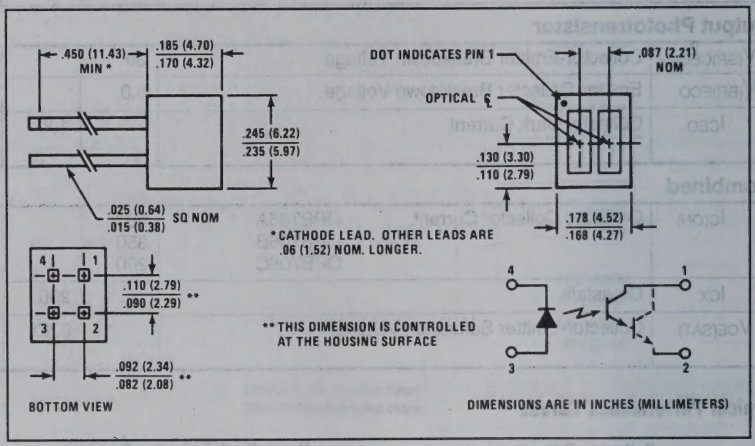



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Reflective Object Sensors
## Types OPB707A, OPB707B, OPB707C






### Features

- Photodarlington output
- Unfocused for sensing diffuse surface
- Low cost plastic housing

### Description

The OPB707 consists of an infrared emitting diode and an NPN silicon photodarlington mounted "side-by-side" on parallel axes in a black plastic housing. Both the emitting diode and photodarlington are molded out of black infrared transmissive plastic to reduce ambient light noise. The photodarlington responds to radiation from the emitter only when a reflective object passes within its field of view.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Forward DC Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 75mW(2)

**Output Photodarlington**

Collector-Emitter Voltage ..... 15.0
Emitter-Collector Voltage ..... 5.0V
Collector DC Current ..... 125mA
Power Dissipation ..... 100mW(3)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.25mW/°C above 25°C.
(3) Derate linearly 1.67mW/°C above 25°C.
(4) d is the distance from the assembly face to the reflective surface.
(5) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(6) Crosstalk (Icx) is the collector current measured with the indicated current in the input diode and with no reflecting surface.
(7) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(8) All parameters tested using pulse technique.

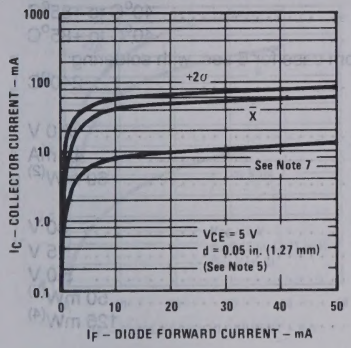
# Types OPB707A, OPB707B, OPB707C

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

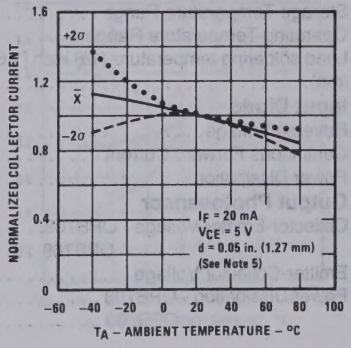
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Photodarlington** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 15.0 | | V | $I_C$ = 100µA, |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100µA, |
| $I_{CEO}$ | Collector Dark Current | | | 250 | nA | $V_{CE}$ = 5.0V, $I_F$ = 0, $E_e \le 0.1\mu W/cm^2$ |
| **Combined** | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | OPB707A<br>OPB707B<br>OPB707C | 25<br>17<br>10 | | mA<br>mA<br>mA | $V_{CE}$ = 5.0V, $I_F$ = 20mA, d = 0.050 in. (1.27mm)(4)(5) |
| $I_{CX}$ | Crosstalk | | | 10 | µA | $V_{CE}$ = 5.0V, $I_F$ = 20mA,(6) |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 1.10 | V | $I_F$ = 20mA, $I_C$ = 2mA, d = 0.050 in. (1.27mm)(4)(5) |

## Typical Performance Curves

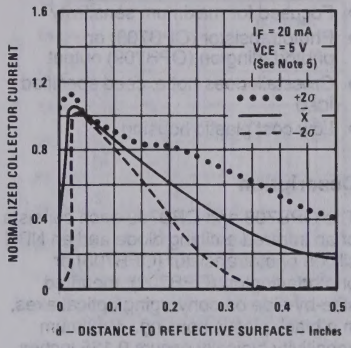
**Collector Current vs. Diode Forward Current**



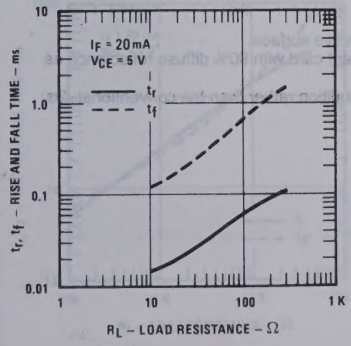

**Normalized Collector Current vs. Ambient Temperature**



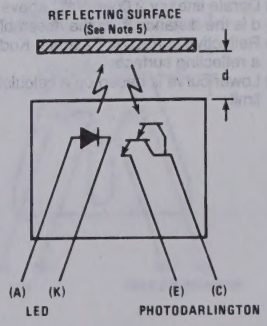

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**



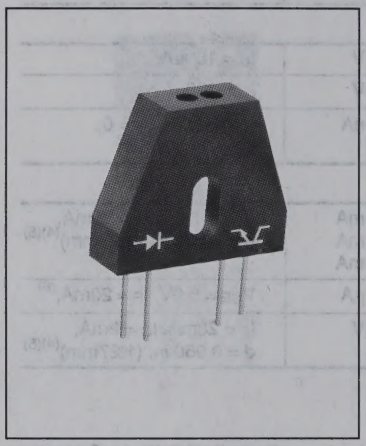

**Test Condition**

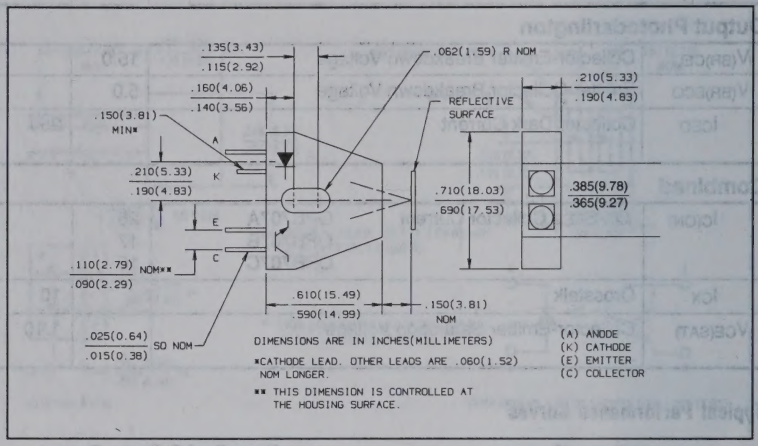



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

# Reflective Object Sensors
## Types OPB708, OPB709






### Features

- Focused for maximum sensitivity
- Phototransistor (OPB708) or photodarlington (OPB709) output
- Crosstalk does not exceed specified $I_{CEO}$
- Low cost plastic housing

### Description

The OPB708 and OPB709 each consists of an infrared emitting diode and an NPN silicon phototransistor (OPB708) or photodarlington (OPB709), mounted side-by-side on converging optical axes, in a black plastic housing. Maximum sensitivity typically occurs 0.125 inches from the front of the housing.

The photosensor responds to radiation from the LED only when a reflective object passes within its field of view.

Both parts are constructed using either OP165 or OP265 series LEDs. The OPB708 uses an OP505 type phototransistor and the OPB709 uses an OP535 type photodarlington.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature Range | -40°C to +85°C |
| Operating Temperature Range | -40°C to +85°C |
| Lead soldering temperature (1/6 inch [1.6 mm] from case for 5 sec. with soldering iron) | 240°C |
| **Input Diode** | |
| Reverse Voltage | 2.0 V |
| Continuous Forward Current | 40 mA |
| Power Dissipation | 60 mW(2) |
| **Output Photosensor** | |
| Collector-Emitter Voltage - OPB708 | 30 V |
| OPB709 | 15 V |
| Emitter-Collector Voltage | 5.0 V |
| Power Dissipation - OPB708 | 50 mW(3) |
| OPB709 | 125 mW(4) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.00 mW/°C above 25°C.
(3) Derate linearly 0.83 mW/°C above 25°C.
(4) Derate linearly 2.08 mW/°C above 25°C.
(5) d is the distance from the assembly face to the reflective surface.
(6) Reflective surface is Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(7) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

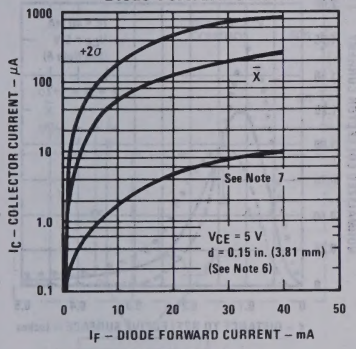
# Types OPB708

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

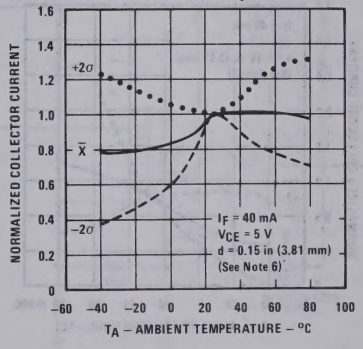
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 40 mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0 V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 100 µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100 µA |
| $I_{CEO}$ | Collector Dark Current | | 100 | nA | $V_{CE}$ = 10.0 V, $I_F$ = 0, $E_e$ = 0 |
| **Combined** | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 10.0 | | µA | $V_{CE}$ = 5.0 V, $I_F$ = 40 mA, d = 0.150" (3.81 mm)(5)(6) |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.40 | V | $I_F$ = 40 mA, $I_C$ = 3.0 µA, d = 0.150" (3.81 mm)(5)(6) |

## Typical Performance Curves

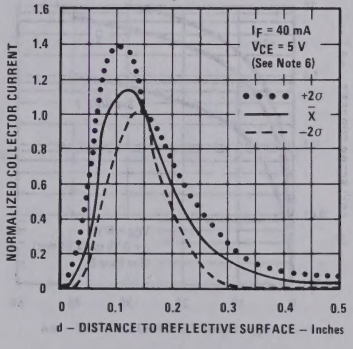
**Collector Current vs. Diode Forward Current**



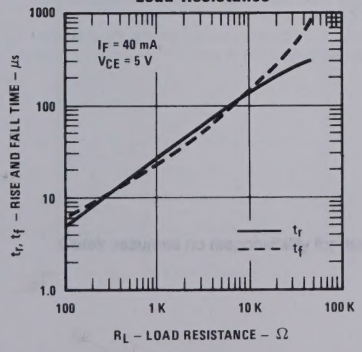

**Normalized Collector Current vs. Ambient Temperature**



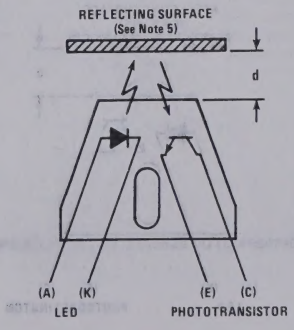

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**




**Test Condition**



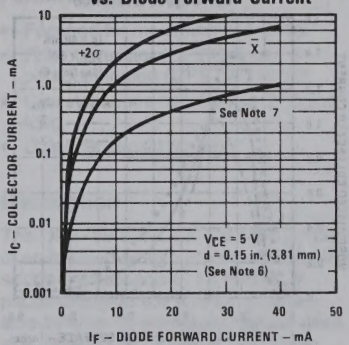
# Types OPB709

**Electrical Characcteristics** ($T_A$ = 25°C unless otherwise noted)

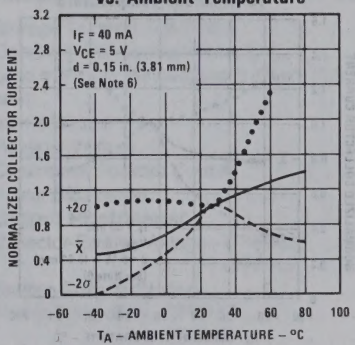
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 40 mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0 V |
| **Output Photodarlington** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 15.0 | | V | $I_C$ = 100 µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100 µA |
| $I_{CEO}$ | Collector Dark Current | | 250 | nA | $V_{CE}$ = 10.0 V, $I_F$ = 0, $E_e$ = 0 |
| **Combined** | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 1.00 | | mA | $V_{CE}$ = 5.0 V, $I_F$ = 40 mA, d = 0.150" (3.81 mm)(5)(6) |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 1.10 | V | $I_F$ = 40 mA, $I_C$ = 300 µA, d = 0.150" (3.81 mm)(5)(6) |

## Typical Performance Curves

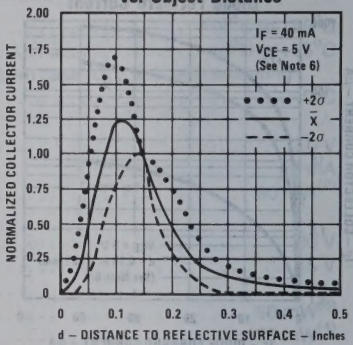
**Collector Current vs. Diode Forward Current**



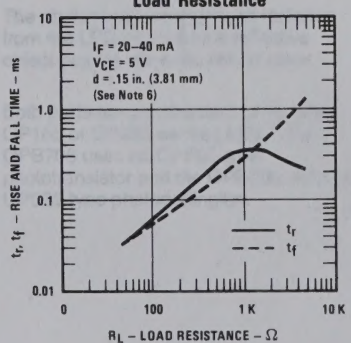

**Normalized Collector Current vs. Ambient Temperature**



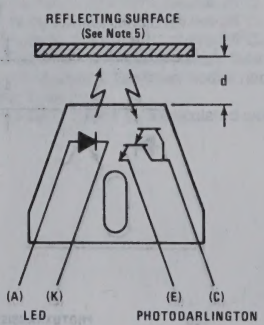

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**



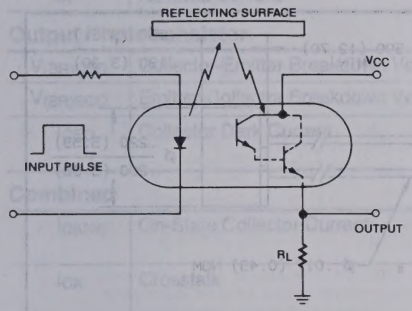

**Test Condition**



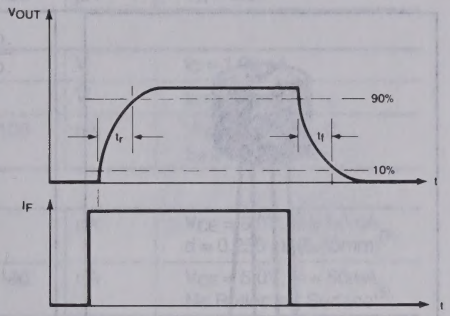

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

### Response Time Test Circuit

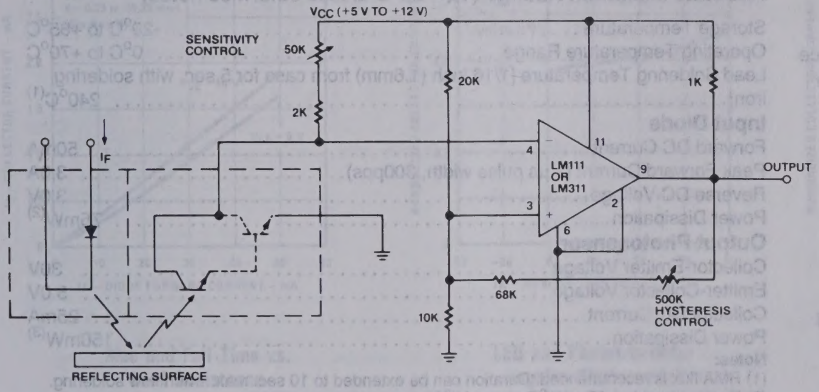



### Switching Time Waveforms



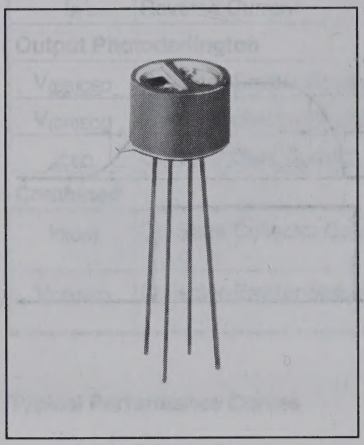

### Typical Interfacing Circuit

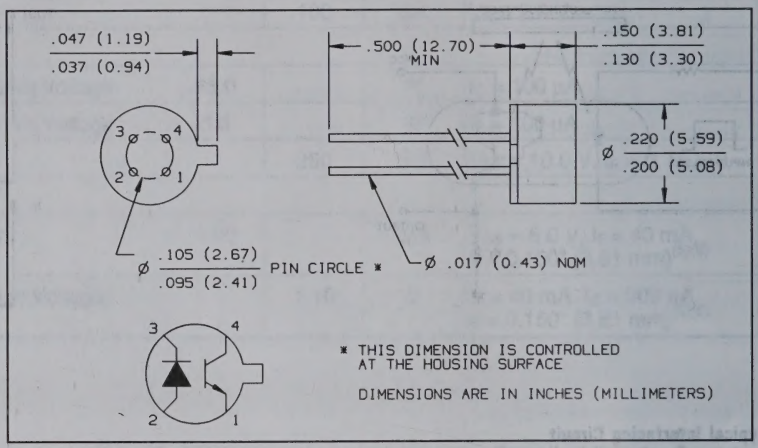
**Recommended for applications requiring adjustments on both sensitivity and hysteresis.**




Optek assumes no responsibility for use of any circuits shown and makes no representation that they are free from patent infringement.

# Reflective Object Sensors
## Types OPB710, OPB710F






### Features

- Phototransistor output
- Unfocused for sensing diffuse surface
- Mounted on standard TO-72 header
- Available in clear encapsulating epoxy (OPB710) or filtered (OPB710F) to reduce the effect of visible or fluorescent light.

### Description

The OPB710 and OPB710F each consist of a gallium arsenide infrared emitting diode and an NPN silicon phototransistor.The emitting diode and detector are mounted side by side on parallel axes on a standard TO-72 header. A black plastic sleeve is attached and filled with encapsulating epoxy to cover the emitter and detector. The "F" version has a filtering material added to the epoxy to reduce the effect of ambient light. The package contains an internal barrier which prevents diode emissions from reaching the sensor directly.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature | -20°C to +85°C |
| Operating Temperature Range | 0°C to +70°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300pps) | 3.0A |
| Reverse DC Voltage | 3.0V |
| Power Dissipation | 75mW(2) |
| **Output Photosensor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 25mA |
| Power Dissipation | 150mW(3) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67 mW/°C above 25°C.
(3) Derate Linearly 3.33 mW/°C above 25°C.
(4) Measured using an Eastman Kodak neutral white test card having 90% diffuse reflectance located 0.250 inch (6.35mm) from the face of the OPB710.
(5) Crosstalk (Icx) is the collector current measured with the indicated current on the input diode and with no reflecting surface. Ambient light is excluded with a black box.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

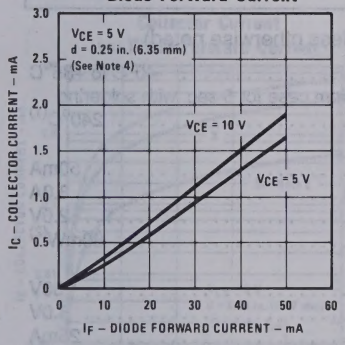
# Types OPB710, OPB710F

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

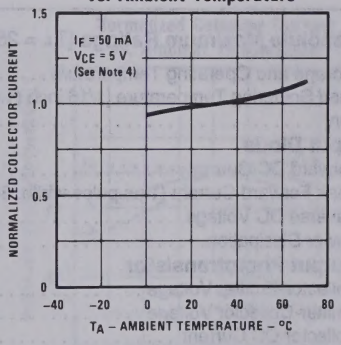
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.50 | V | $I_F$ = 50mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 3.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | | V | $I_C$ = 1.00mA, |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | | V | $I_E$ = 100µA, |
| $I_{CEO}$ | Collector Dark Current | | | 100 | nA | $V_{CE}$ = 5.0V, $I_F$ = 0, $E_e \leq 0.1\mu W/cm^2$ |
| **Combined** | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 150 | | | µA | $V_{CE}$ = 5.0V, $I_F$ = 50mA, d = 0.250 in. (6.35mm)(4) |
| $I_{CX}$ | Crosstalk | | | 100 | nA | $V_{CE}$ = 5.0V, $I_F$ = 50mA, No Reflecting Surface(5) |

## Typical Performance Curves

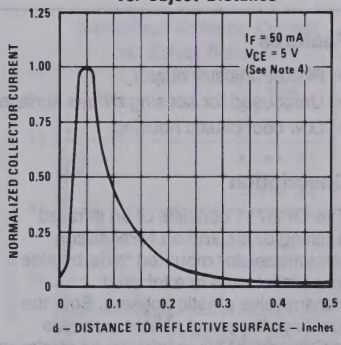
**Collector Current vs. Diode Forward Current**



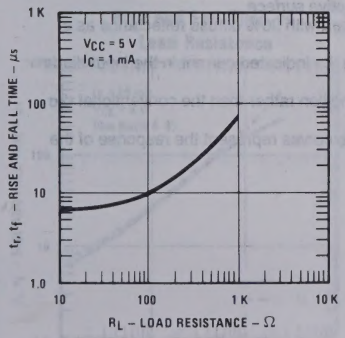

**Normalized Collector Current vs. Ambient Temperature**



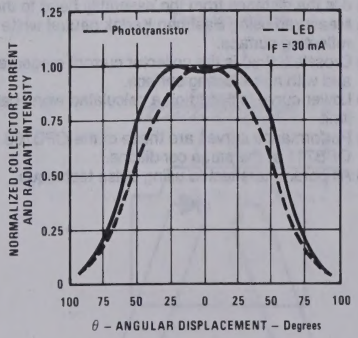

**Normalized Collector Current vs. Object Distance**



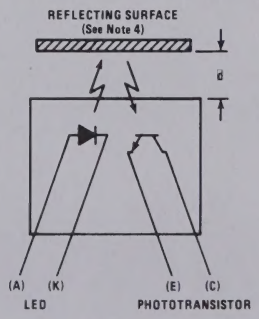

**Rise and Fall Time vs. Load Resistance**




**LED and Phototransistor Angular Displacement**



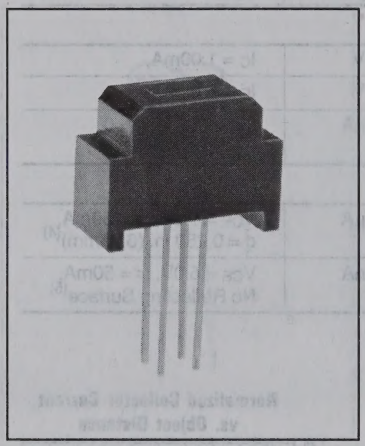

**Test Condition**

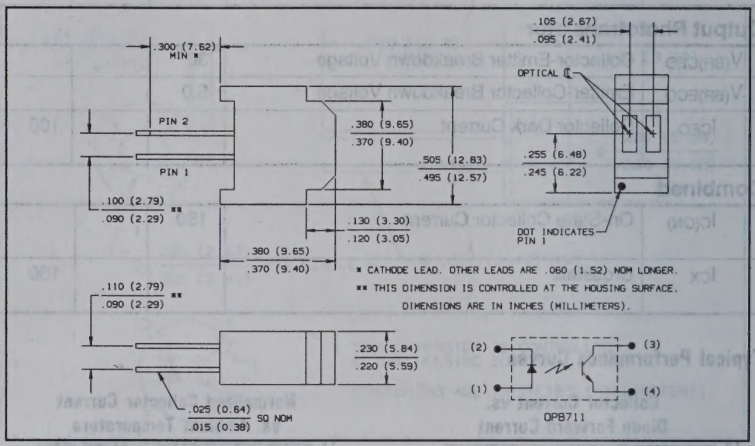



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Reflective Object Sensor
## Type OPB711






### Features

- Phototransistor output
- Unfocused for sensing diffuse surface
- Low cost plastic housing

### Description

The OPB711 consists of an infrared emitting diode and an NPN silicon phototransistor mounted "side-by-side" on parallel axes in a infrared transmissive plastic housing. Both the emitting diode and photosensor are molded out of black infrared transmissive plastic to reduce ambient light noise. The photosensor responds to radiation from the emitter only when a reflective object passes within its field of view.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Forward DC Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 80mW(2)

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Collector DC Current ..... 25mA
Power Dissipation ..... 80mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) d is the distance from the assembly head to the reflective surface.
(4) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Crosstalk ($I_{CX}$) is the collector current measured with the indicated current in the input diode and with no reflecting surface.
(6) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(7) Performance curves are those of the OPB706. These curves represent the response of the OPB711 at the same conditions.
(8) All parameters tested using pulse technique.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

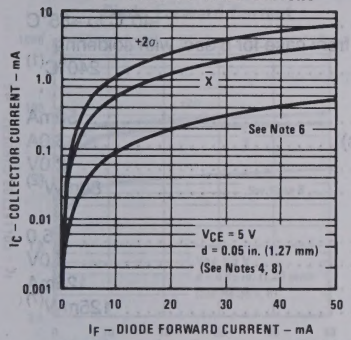
# Type OPB711

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

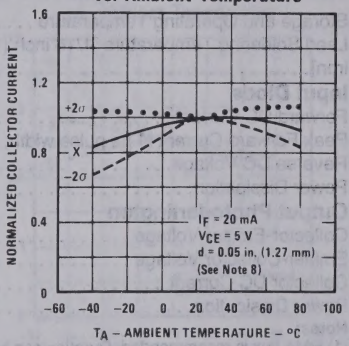
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 100µA, |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA, |
| $I_{CEO}$ | Collector Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e \leq 0.1\mu W/cm^2$ |
| **Combined** | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 350 | | µA | $V_{CE}$ = 5.0V, $I_F$ = 20mA, d = 0.080 in. (2.03mm)(3)(4) |
| $I_{CX}$ | Crosstalk | | 100 | nA | $V_{CE}$ = 5.0V, $I_F$ = 20mA, No Reflecting Surface(5) |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.40 | V | $I_F$ = 20mA, $I_C$ = 50µA, d = 0.080 in. (2.03mm)(3)(4) |

## Typical Performance Curves

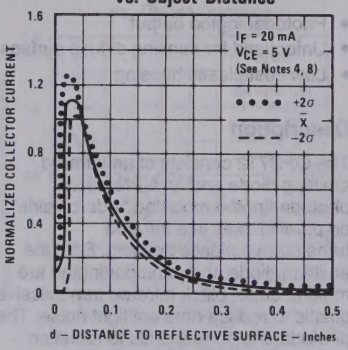
**Collector Current vs. Diode Forward Current**



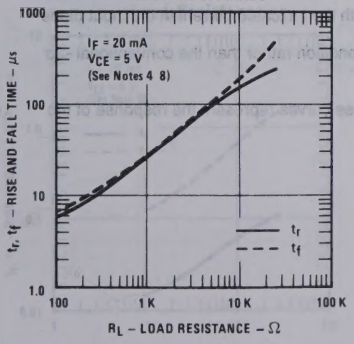

**Normalized Collector Current vs. Ambient Temperature**



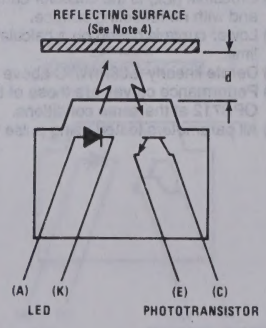

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**

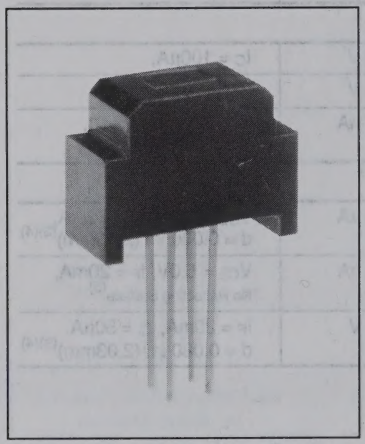


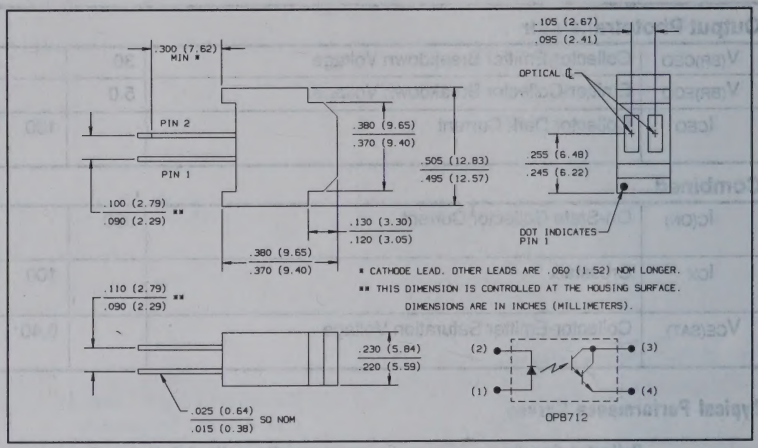

**Test Condition**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Reflective Object Sensor
## Type OPB712






### Features

- Photodarlington output
- Unfocused for sensing diffuse surface
- Low cost plastic housing

### Description

The OPB712 consists of an infrared emitting diode and an NPN silicon photodarlington mounted "side-by-side" on parallel axes in a infrared transmissive plastic housing. Both the emitting diode and photodarlington are molded out of black infrared transmissive plastic to reduce ambient light noise. The photodarlington responds to radiation from the emitter only when a reflective object passes within its field of view.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Forward DC Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 80mW(2)

**Output Photodarlington**

Collector-Emitter Voltage ..... 15.0
Emitter-Collector Voltage ..... 5.0V
Collector DC Current ..... 125mA
Power Dissipation ..... 125mW(7)

**Notes:**

(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) d is the distance from the assembly head to the reflective surface.
(4) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Crosstalk ($I_{CX}$) is the collector current measured with the indicated current in the input diode and with no reflecting surface.
(6) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(7) Derate linearly 2.08mW/°C above 25°C.
(8) Performance curves are those of the OPB707. These curves represent the response of the OPB712 at the same conditions.
(9) All parameters tested using pulse technique.

# Type OPB712

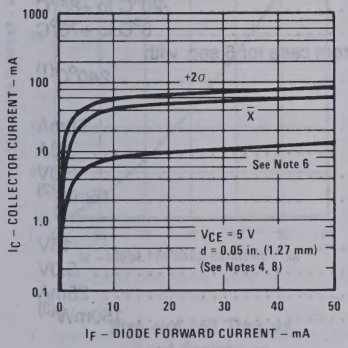


**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

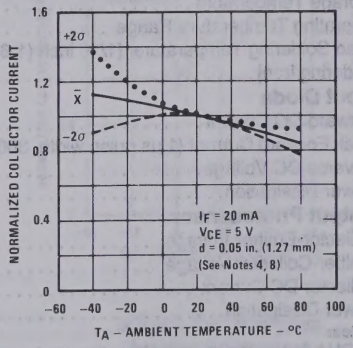
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Photodarlington** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 15 | | V | $I_C$ = 100µA, |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA, |
| $I_{CEO}$ | Collector Dark Current | | 250 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e \leq 0.1\mu W/cm^2$ |
| **Combined** | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 20 | | mA | $V_{CE}$ = 5.0V, $I_F$ = 20mA, d = 0.080 in. (2.03mm) (3)(4) |
| $I_{CX}$ | Crosstalk | | 25 | µA | $V_{CE}$ = 5.0V, $I_F$ = 20mA, No Reflecting Surface (5) |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 1.10 | V | $I_F$ = 20mA, $I_C$ = 5.0mA, d = 0.080 in. (2.03mm) (3)(4) |

## Typical Performance Curves

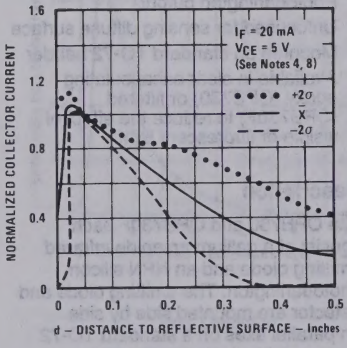
**Collector Current vs. Diode Forward Current**



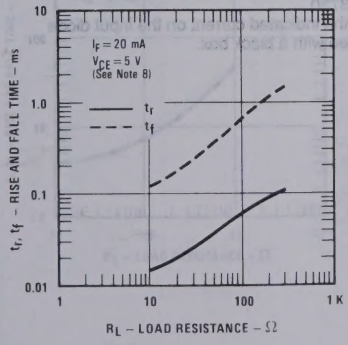

**Normalized Collector Current vs. Ambient Temperature**



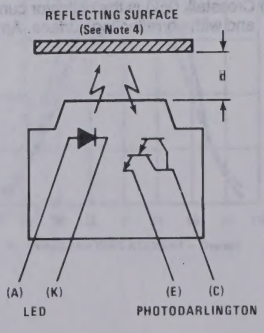

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**



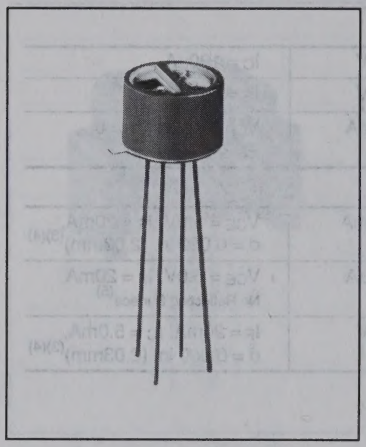

**Test Condition**

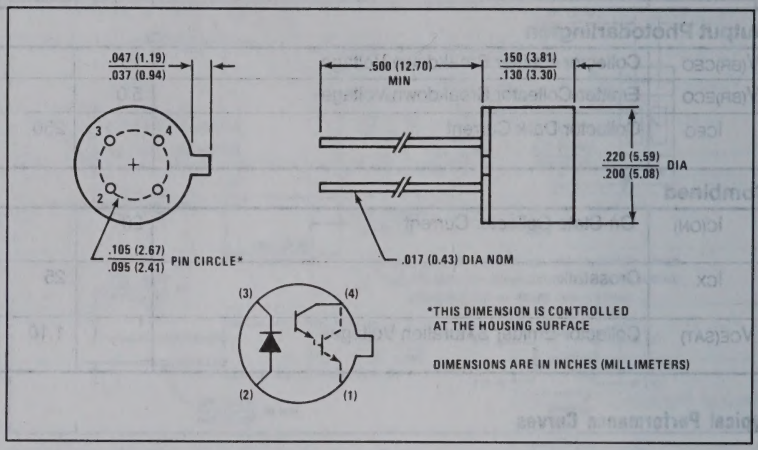



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Reflective Object Sensors
## Types OPB730, OPB730F






### Features

- Photodarlington output
- Unfocused for sensing diffuse surface
- Mounted on standard TO-72 header
- Available in clear encapsulating epoxy (OPB730) or filtered (OPB730F) to reduce the effect of visible or fluorescent light.

### Description

The OPB730 and OPB730F each consist of a gallium arsenide infrared emitting diode and an NPN silicon photodarlington. The emitting diode and detector are mounted side by side on parallel axes on a standard TO-72 header. A black plastic sleeve is attached and filled with encapsulating epoxy to cover the emitter and detector. The "F" version has a filtering material added to the epoxy to reduce the effect of ambient light. An internal barrier prevents light from reaching the detector directly.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature | -20°C to +85°C |
| Operating Temperature Range | 0°C to +70°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300pps) | 3.0A |
| Reverse DC Voltage | 3.0V |
| Power Dissipation | 75mW(2) |
| **Output Photosensor** | |
| Collector-Emitter Voltage | 15V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 25mA |
| Power Dissipation | 150mW(3) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67 mW/°C above 25°C.
(3) Derate Linearly 3.33 mW/°C above 25°C.
(4) Measured using an Eastman Kodak neutral white test card having 90% diffuse reflectance located 0.250 inch (6.35mm) from the face of the OPB730.
(5) Crosstalk ($I_{CX}$) is the collector current measured with the indicated current on the input diode and with no reflecting surface. Ambient light is excluded with a black box.

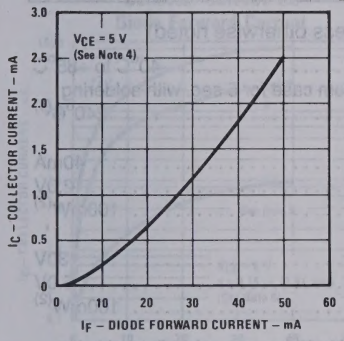
# Types OPB730, OPB730F

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

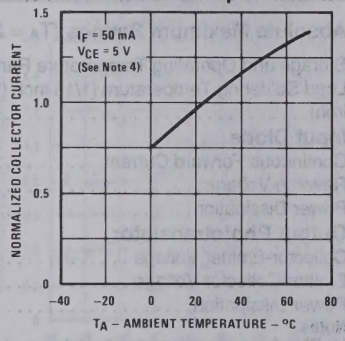
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.50 | V | $I_F$ = 50mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 3.0V |
| **Output Photodarlington** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 15 | | | V | $I_C$ = 1.00mA, |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | | V | $I_E$ = 100µA, |
| $I_{CEO}$ | Collector Dark Current | | | 250 | nA | $V_{CE}$ = 5.0V, $I_F$ = 0, $E_e \leq 0.1\mu W/cm^2$ |
| **Combined** | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 1.0 | | | mA | $V_{CE}$ = 5.0V, $I_F$ = 50mA, d = 0.250 in. (6.35mm)(4) |
| $I_{CX}$ | Crosstalk | | | 500 | nA | $V_{CE}$ = 5.0V, $I_F$ = 50mA, No Reflecting Surface(5) |

## Typical Performance Curves

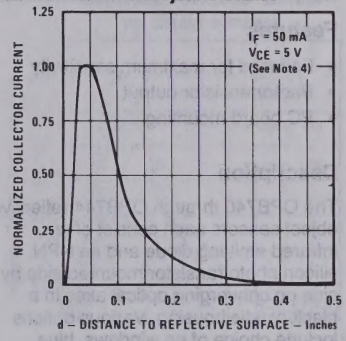
**Collector Current vs. Diode Forward Current**



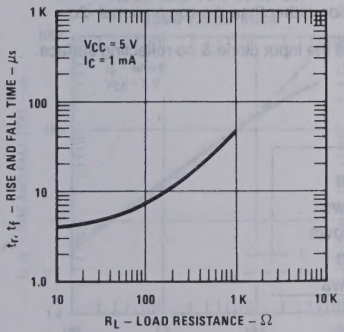

**Normalized Collector Current vs. Ambient Temperature**



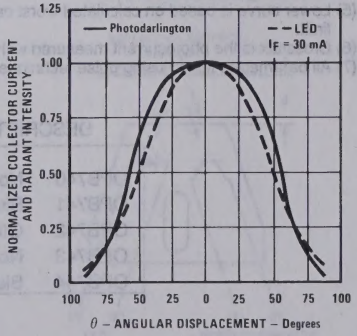

**Normalized Collector Current vs. Object Distance**



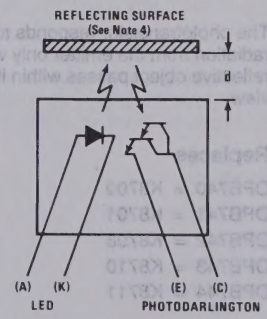

**Rise and Fall Time vs. Load Resistance**




**LED and Photodarlington Angular Displacement**

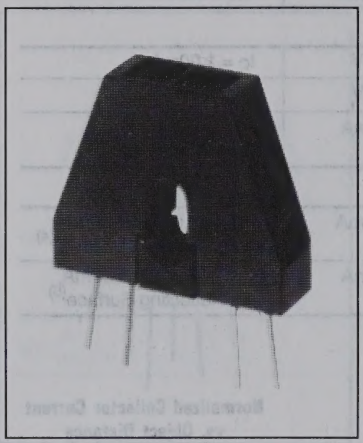


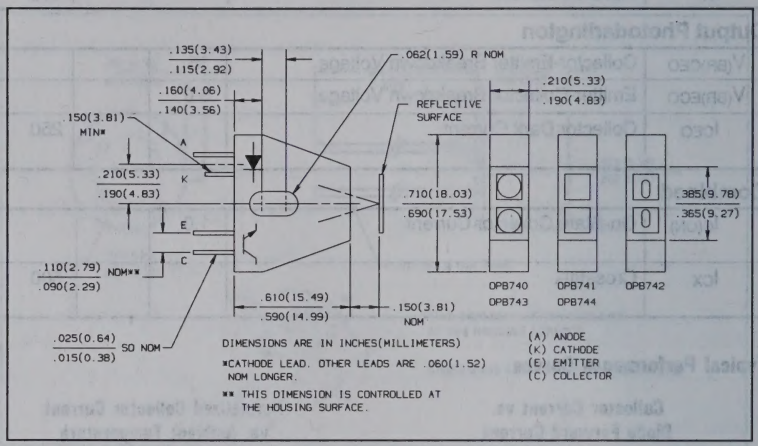

**Test Condition**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Reflective Object Sensors
## Types OPB740, OPB741, OPB742, OPB743, OPB744






### Features

- Focused for maximum sensitivity
- Phototransistor output
- PC board mounting

### Description

The OPB740 through OPB744 reflective object sensors each consist of an infrared emitting diode and an NPN silicon phototransistor mounted side by side on converging optical axes in a black plastic housing. Various options include choice of no windows, blue polysulfone windows for dust protection or opaque windows with offset openings for improved resolution. Available with wires as OPB740W/OPB744W series.

The phototransistor responds to radiation from the emitter only when a reflective object passes within its field of view.

### Replaces

OPB740 = K8700
OPB741 = K8701
OPB742 = K8708
OPB743 = K8710
OPB744 = K8711

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Continuous Forward Current ..... 40mA
Reverse Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67mW/°C above 25°C.
(3) d is distance from the assembly face to the reflective surface.
(4) Reflective surface is Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Lower curve is based on calculated worst case condition rather than the conventional -2σ limit.
(6) Crosstalk is the photocurrent measured with current to the input diode & no reflecting surface.
(7) All parameters tested using pulse technique.

| | DESCRIPTION |
|---|---|
| OPB740 | No windows |
| OPB741 | Blue windows |
| OPB742 | Offset windows |
| OPB743 | No windows |
| OPB744 | Blue windows |

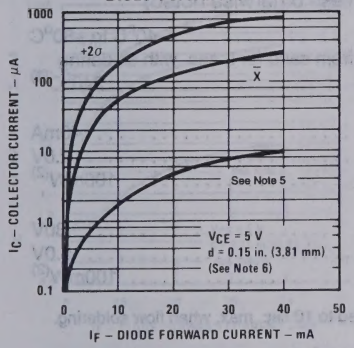
# Types OPB740, OPB741, OPB742, OPB743, OPB744

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

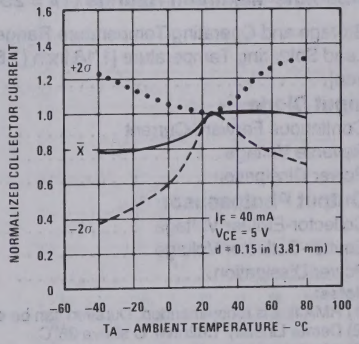
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F$ = 40mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector Dark Current | | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | | |
| $I_{C(ON)}$ (3)(4) | On-State Collector Current | OPB740/OPB741 | 50 | | µA | $V_{CE}$ = 5V, $I_F$ = 40mA, d = 0.15" |
| | | OPB742 | 10 | | µA | $V_{CE}$ = 5V, $I_F$ = 40mA, d = 0.15" |
| | | OPB743/OPB744 | 200 | | µA | $V_{CE}$ = 5V, $I_F$ = 40mA, d = 0.15" |
| $I_{CX}$ (6) | Crosstalk | OPB740/OPB741 | | 10 | µA | $V_{CC}$ = 5V, $I_F$ = 40mA |
| | | OPB742 | | 100 | nA | $V_{CC}$ = 5V, $I_F$ = 40mA |
| | | OPB743/OPB744 | | 20 | µA | $V_{CC}$ = 5V, $I_F$ = 40mA |

## Typical Performance Curves

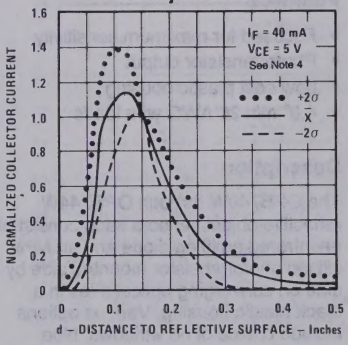
**Collector Current vs. Diode Forward Current**



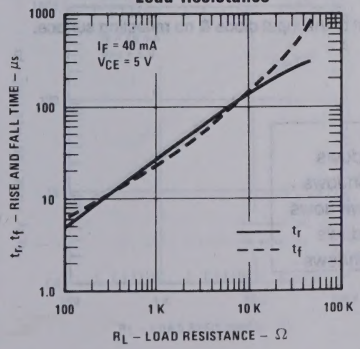

**Normalized Collector Current vs. Ambient Temperature**



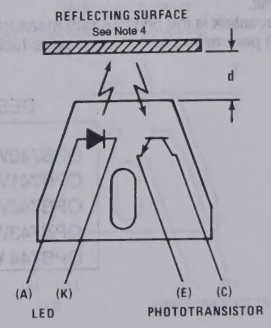

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**



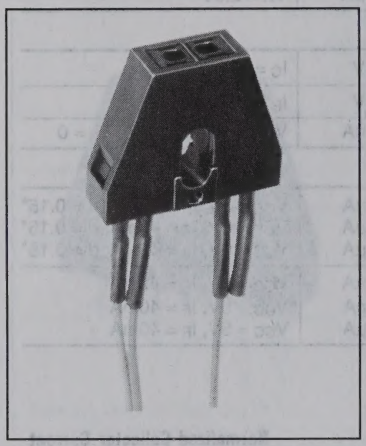

**Test Condition**

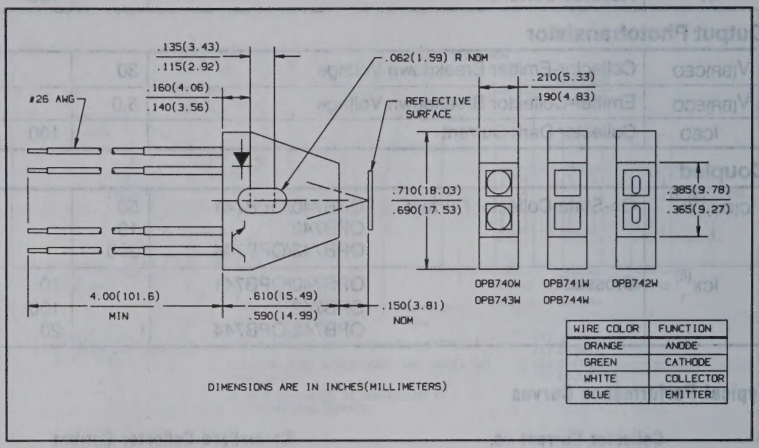



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Reflective Object Sensors
## Types OPB740W, OPB741W, OPB742W, OPB743W, OPB744W






### Features

- Focused for maximum sensitivity
- Phototransistor output
- Low cost plastic housing
- 4.0" min 26 AWG wire leads

### Description

The OPB740W through OPB744W reflective object sensors each consist of an infrared emitting diode and an NPN silicon phototransistor mounted side by side on converging optical axes in a black plastic housing. Various options include choice of no windows, blue polysulfone windows for dust protection or opaque windows with offset openings for improved resolution. Available with PC board mounting as OPB740/OPB744 series.

The photosensor responds to radiation from the emitter only when a reflective object passes within its field of view.

### Replaces

OPB740W = K8702
OPB741W = K8703
OPB743W = K8712
OPB744W = K8713

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +80°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Continuous Forward Current ..... 40mA
Reverse Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

**Output Photosensor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.82mW/°C above 25°C.
(3) d is distance from the assembly face to the reflective surface.
(4) Reflective surface is Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Lower curve is based on calculated worst case condition rather than the conventional -2σ limit.
(6) Crosstalk is the photocurrent measured with current to the input diode & no reflecting surface.
(7) All parameters tested using pulse technique.

| | DESCRIPTION |
|---|---|
| OPB740W | No windows |
| OPB741W | Blue windows |
| OPB742W | Offset windows |
| OPB743W | No windows |
| OPB744 W | Blue windows |

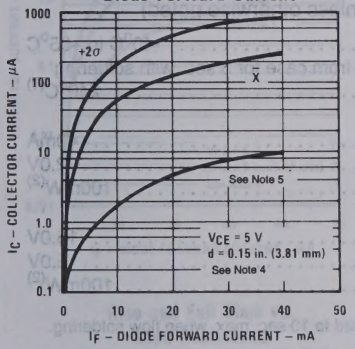
# Types OPB740W, OPB741W, OPB742W, OPB743W, OPB744W

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

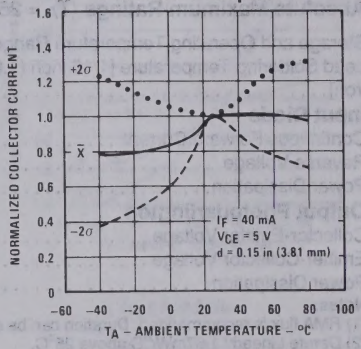
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F$ = 40mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector Dark Current | | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | | |
| $I_{C(ON)}$[3][4] | On-State Collector Current | OPB740W/OPB741W | 50 | | µA | $V_{CE}$ = 5V, $I_F$ = 40mA, d = 0.15" |
| | | OPB742W | 10 | | µA | $V_{CE}$ = 5V, $I_F$ = 40mA, d = 0.15" |
| | | OPB743W/OPB744W | 200 | | µA | $V_{CE}$ = 5V, $I_F$ = 40mA, d = 0.15" |
| $I_{CX}$[6] | Crosstalk | OPB740W/OPB741W | | 10 | µA | $V_{CC}$ = 5V, $I_F$ = 40mA |
| | | OPB742W | | 100 | nA | $V_{CC}$ = 5V, $I_F$ = 40mA |
| | | OPB743W/OPB744W | | 20 | µA | $V_{CC}$ = 5V, $I_F$ = 40mA |

## Typical Performance Curves

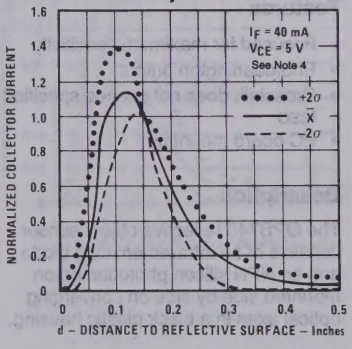
**Collector Current vs. Diode Forward Current**



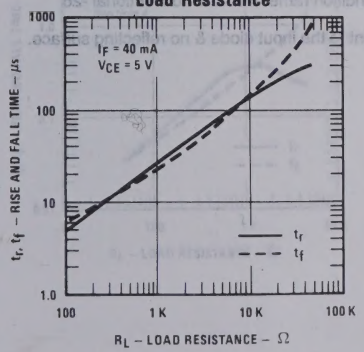

**Normalized Collector Current vs. Ambient Temperature**



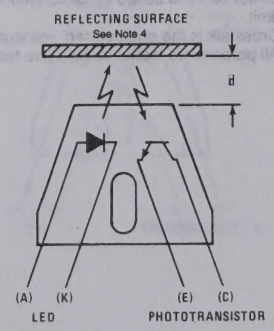

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**

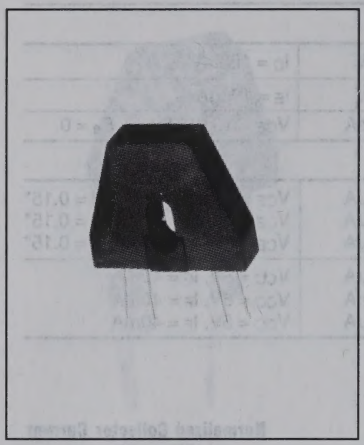


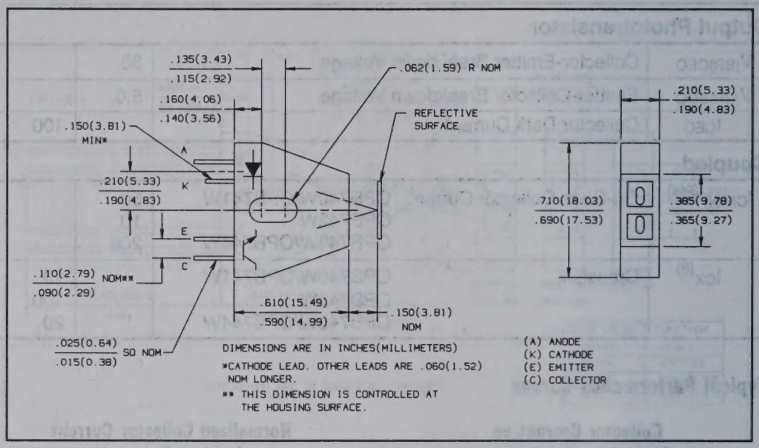

**Test Condition**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Reflective Object Sensor
## Type OPB745






### Features

- Focused for maximum sensitivity
- Photodarlington output
- Crosstalk does not exceed specified $I_{CEO}$
- PC board mounting

### Description

The OPB745 reflective object sensor consists of an infrared emitting diode and an NPN silicon photodarlington mounted side by side on converging optical axes in a black plastic housing.

The photodarlington responds to radiation from the emitter only when a reflective object passes within its field of view.

### Replaces

K8709

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Continuous Forward Current ..... 40mA
Reverse Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

**Output Photodarlington**

Collector-Emitter Voltage ..... 15.0V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67mW/°C above 25°C.
(3) d is distance from the assembly face to the reflective surface.
(4) Reflective surface is Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Lower curve is based on calculated worst case condition rather than the conventional -2σ limit.
(6) Crosstalk is the photocurrent measured with current to the input diode & no reflecting surface.
(7) All parameters tested using pulse technique.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

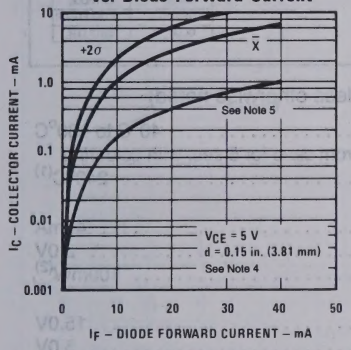
# Type OPB745

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

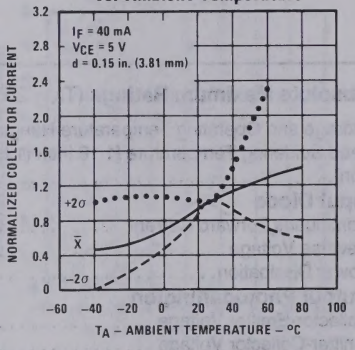
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 40mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Photodarlington** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 15 | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector Dark Current | | 250 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $I_{C(ON)}$ (3)(4) | On-State Collector Current | 1.00 | | mA | $V_{CE}$ = 5V, $I_F$ = 40mA, d = 0.15" |
| $I_{CX}$ (2) | Crosstalk | | 250 | nA | $V_{CC}$ = 5V, $I_F$ = 40mA |

## Typical Performance Curves

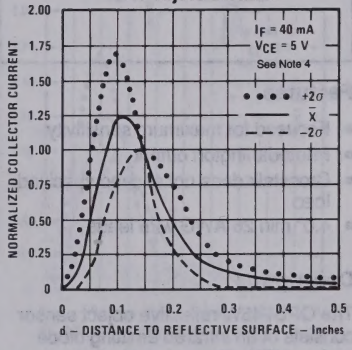
**Collector Current vs. Diode Forward Current**



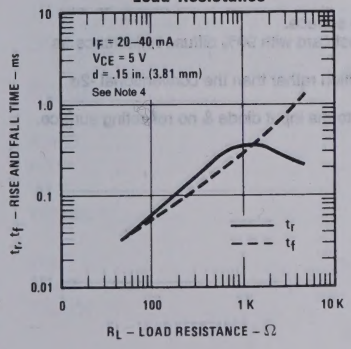

**Normalized Collector Current vs. Ambient Temperature**



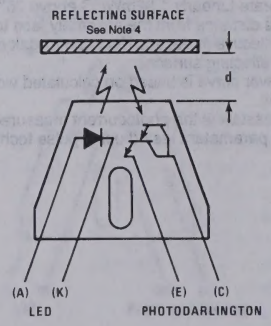

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**



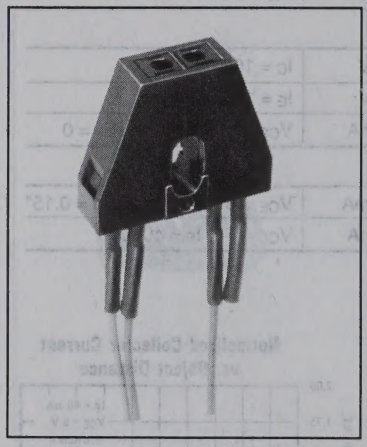

**Test Condition**

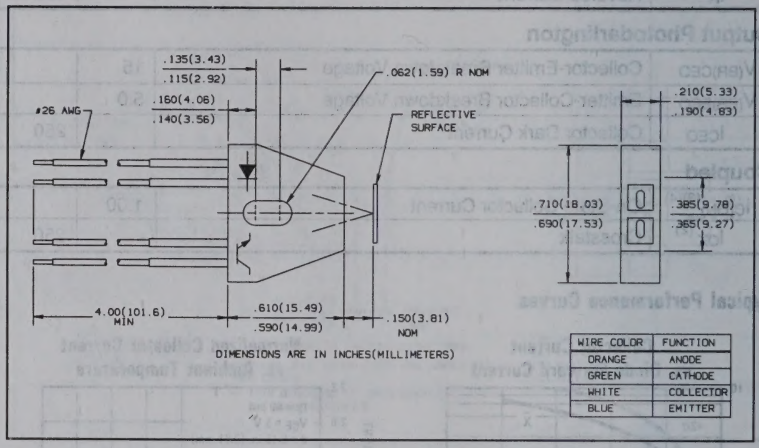



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Reflective Object Sensor
## Type OPB745W






| WIRE COLOR | FUNCTION |
|---|---|
| ORANGE | ANODE |
| GREEN | CATHODE |
| WHITE | COLLECTOR |
| BLUE | EMITTER |

### Features

- Focused for maximum sensitivity
- Photodarlington output
- Crosstalk does not exceed specified $I_{CEO}$
- 4.0" min 26 AWG wire leads

### Description

The OPB745W reflective object sensor consists of an infrared emitting diode and an NPN silicon photodarlington mounted side by side on converging optical axes in a black plastic housing. Available with PC board leads as OPB745.

The photodarlington responds to radiation from the emitter only when a reflective object passes within its field of view.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +80°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Continuous Forward Current ..... 40mA
Reverse Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

**Output Photodarlington**

Collector-Emitter Voltage ..... 15.0V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.82mW/°C above 25°C.
(3) d is distance from the assembly face to the reflective surface.
(4) Reflective surface is Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Lower curve is based on calculated worst case condition rather than the conventional -2σ limit.
(6) Crosstalk is the photocurrent measured with current to the input diode & no reflecting surface.
(7) All parameters tested using pulse technique.

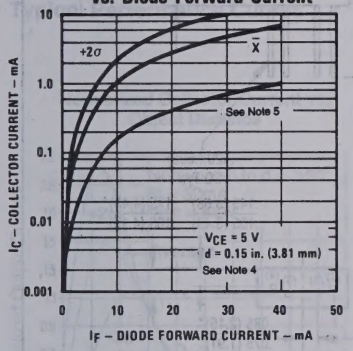
# Type OPB745W

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

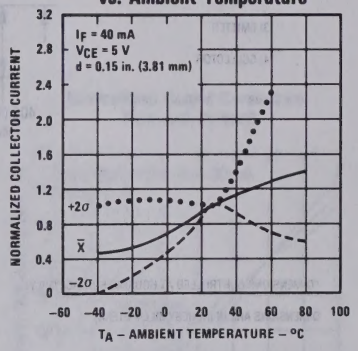
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 40mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Photodarlington** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 15.0 | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector Dark Current | | 250 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $I_{C(ON)}$ (3)(4) | On-State Collector Current | 1.00 | | mA | $V_{CE}$ = 5V, $I_F$ = 40mA, d = 0.15" |
| $I_{CX}$ (6) | Crosstalk | | 250 | nA | $V_{CC}$ = 5V, $I_F$ = 40mA |

## Typical Performance Curves

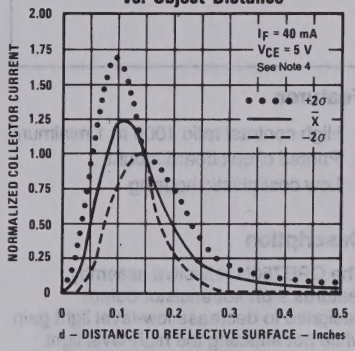
**Collector Current vs. Diode Forward Current**



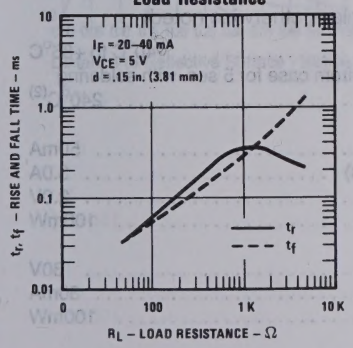

**Normalized Collector Current vs. Ambient Temperature**



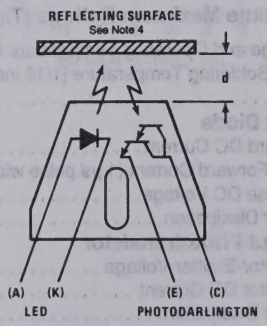

**Normalized Collector Current vs. Object Distance**




**Rise and Fall Time vs. Load Resistance**

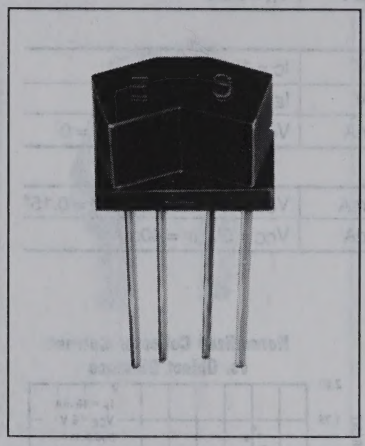


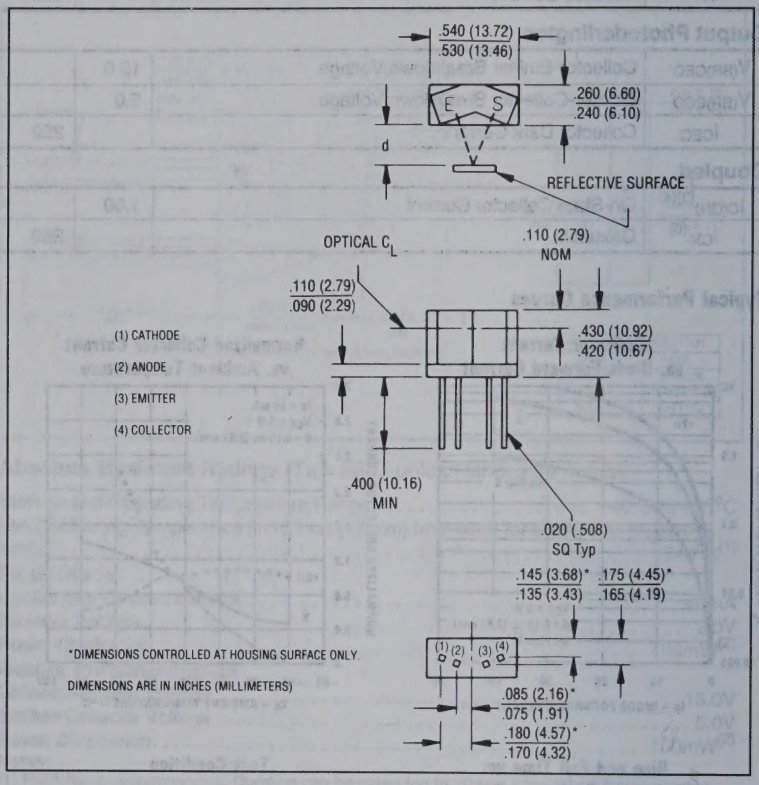

**Test Condition**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Reflective Object Sensor
## Type OPB750N






### Features

- High contrast ratio 1000 to 1 minimum
- Printed circuit board mount
- Low cost plastic housing

### Description

The OPB750N reflective assemby features a phototransistor output designed to decrease low-level light gain while not affecting the high-level light gain. Available with two mounting tabs as OPB750T.

Available with 12", 26 AWG wire leads as OPB755 series. Photologic™ output sensors available in OPB760/OPB770 series.

### Replaces

KR105

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 100mW |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Collector DC Current | 30mA |
| Power Dissipation | 100mW |

**Notes:**
(1) Derate Linearly 1.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(5) Photocurrent is measured using an Eastman Kodak Neutral White test card having a 90% diffuse reflectance as a reflecting surface.
(6) $I_{C(OFF)}$ is the photocurrent measured with current to the input diode and a 5% reflecting surface.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

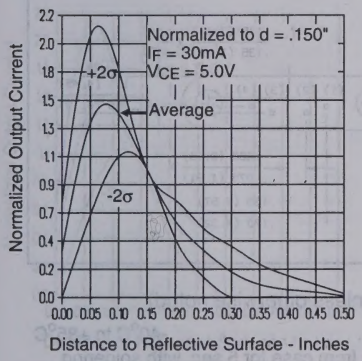
# Type OPB750N

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

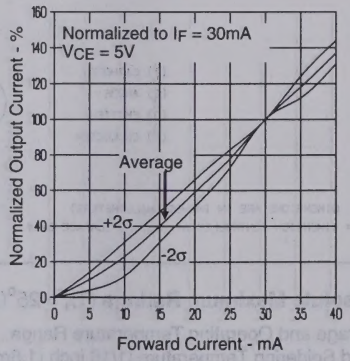
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.8 | V | $I_F$ = 40mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, H = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | | 0.40 | V | $I_C$=150µA, $I_F$= 30mA, d=0.22" |
| $I_{C(ON)}$ | On-State Collector Current | 500<br>375<br>250 | | µA<br>µA<br>µA | $V_{CE}$=5.0V, $I_F$=30mA, d=0.08"(5)<br>$V_{CE}$=5.0V, $I_F$=30mA, d=0.15"(5)<br>$V_{CE}$=5.0V, $I_F$=30mA, d=0.22"(5) |
| $I_{C(OFF)}$ | Off-State Collector Current | | 250 | nA | $I_F$ = 30mA, $V_{CE}$ = 5.0V,(6)<br>d = 0.08", 0.15", 0.22" |

## Typical Performance Curves

**Normalized Collector Current vs. Object Distance**

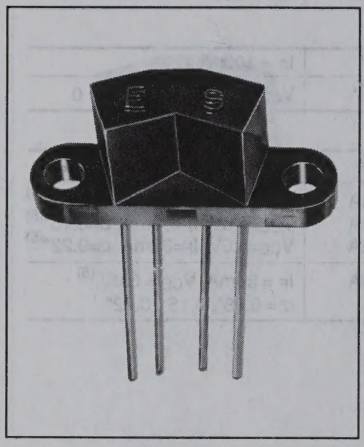


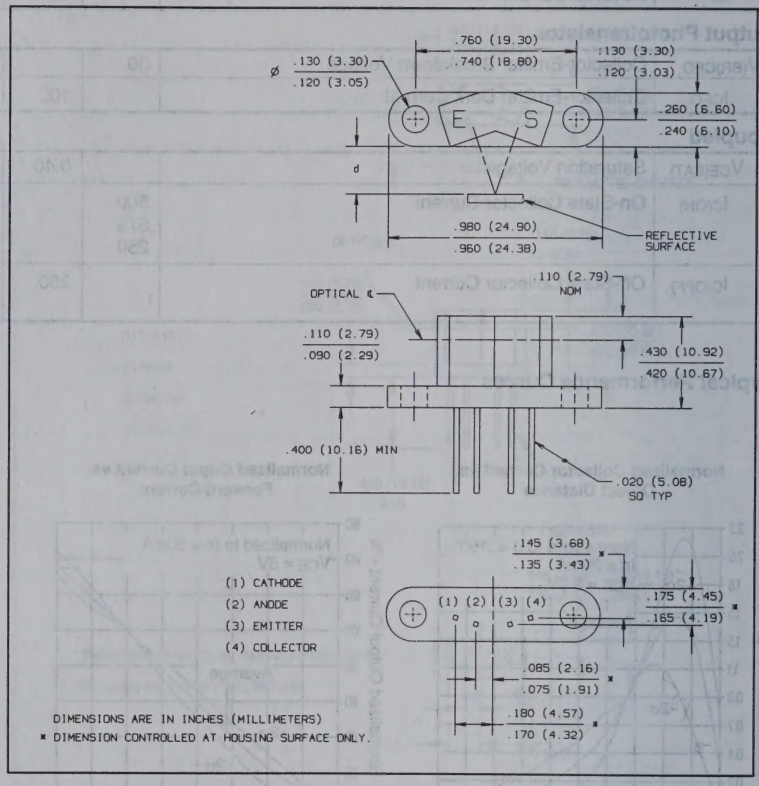

**Normalized Ouput Current vs. Forward Current**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Reflective Object Sensor
## Type OPB750T






### Features

- High contrast ratio, 1000 to 1 minimum
- Printed circuit board mount
- Low cost plastic housing

### Description

The OPB750T reflective assemby features a phototransistor output designed to decrease low-level light gain while not affecting the high-level light gain. Available without mounting tabs as OPB750N.

Available with 12", 26 AWG wire leads as OPB750/OPB755 series. Photologic™ output sensors available in OPB760/OPB770 series.

### Replaces

KR100

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(2)

**Input Diode**

Forward DC Current ..... 50mA
Peak Forward Current (1µs pulse width, 300 pps) ..... 3.0A
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 100mW(1)

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Collector DC Current ..... 30mA
Power Dissipation ..... 100mW(1)

**Notes:**

(1) Derate Linearly 1.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(5) Photocurrent is measured using an Eastman Kodak Neutral White test card having a 90% diffuse reflectance as a reflecting surface .
(6) $I_{C(OFF)}$ is the photocurrent measured with current to the input.

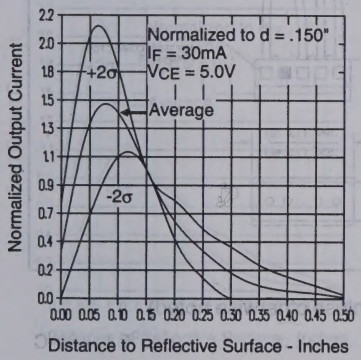
# Type OPB750T

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

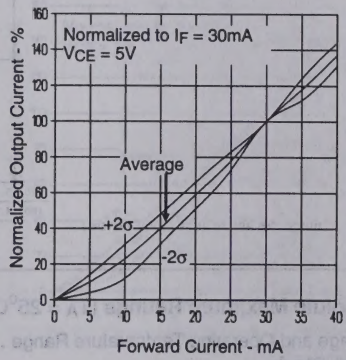
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.8 | V | $I_F$ = 40mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, H = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | | 0.40 | V | $I_C$=150µA, $I_F$= 30mA, d=0.22" |
| $I_{C(ON)}$ | On-State Collector Current | 500<br>375<br>250 | | µA<br>µA<br>µA | $V_{CE}$=5.0V, $I_F$=30mA, d=0.08"(5)<br>$V_{CE}$=5.0V, $I_F$=30mA, d=0.15"(5)<br>$V_{CE}$=5.0V, $I_F$=30mA, d=0.22"(5) |
| $I_{C(OFF)}$ | Off-State Collector Current | | 250 | nA | $I_F$ = 30mA, $V_{CC}$ = 5.0V, (6)<br>d = 0.08", 0.15", 0.22" |

## Typical Performance Curves

**Normalized Collector Current vs. Object Distance**

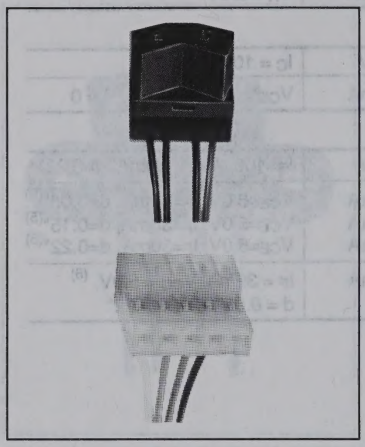


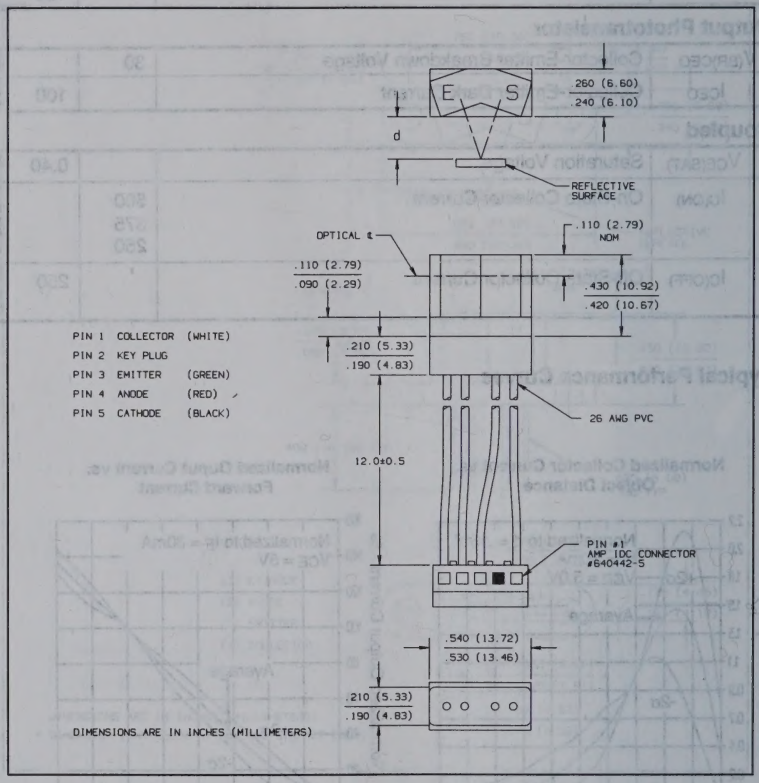

**Normalized Ouput Current vs. Forward Current**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Reflective Object Sensor
## Type OPB755N






### Features

- High contrast ratio 1000 to 1 minimum
- 12.0" ± 0.5" min. UL#1429 26 AWG wire leads terminated into an AMP #640442-5 connector
- Low cost plastic housing

### Description

The OPB755N reflective assemby features a phototransistor output designed to decrease low-level light gain while not affecting the high-level light gain. Available with two mounting tabs as OPB755T.

Available with PC Board mountable leads as OPB750 series. Photologic™ output sensors available in OPB760/OPB770 series.

### Replaces

KR105W

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +80°C

**Input Diode**

Forward DC Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 100mW

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Collector DC Current ..... 30mA
Power Dissipation ..... 100mW

**Notes:**

(1) Derate Linearly 1.82mW/°C above 25°C.
(2) All parameters tested using pulse technique.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) Photocurrent is measured using an Eastman Kodak Neutral White test card having a 90% diffuse reflectance as a reflecting surface.
(5) $I_{C(OFF)}$ is the photocurrent measured with current to the input diode and a 5% reflecting surface.

# Type OPB755N

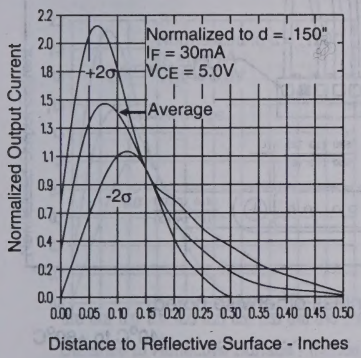


**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

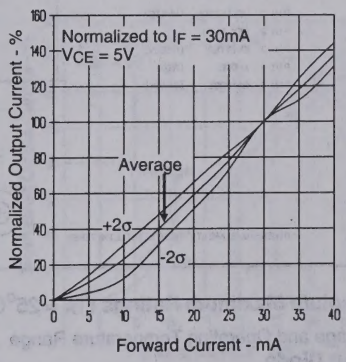
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.8 | V | $I_F$ = 40mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, H = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | | 0.40 | V | $I_C$=150µA, $I_F$= 30mA, d=0.22" |
| $I_{C(ON)}$ | On-State Collector Current | 500<br>375<br>250 | | µA<br>µA<br>µA | $V_{CE}$=5.0V, $I_F$=30mA, d=0.08"(4)<br>$V_{CE}$=5.0V, $I_F$=30mA, d=0.15"(4)<br>$V_{CE}$=5.0V, $I_F$=30mA, d=0.22"(4) |
| $I_{C(OFF)}$ | Off-State Collector Current | | 250 | nA | $I_F$ = 30mA, $V_{CE}$ = 5.0V, (5)<br>d = 0.08", 0.15", 0.22" |

## Typical Performance Curves

**Normalized Collector Current vs. Object Distance**

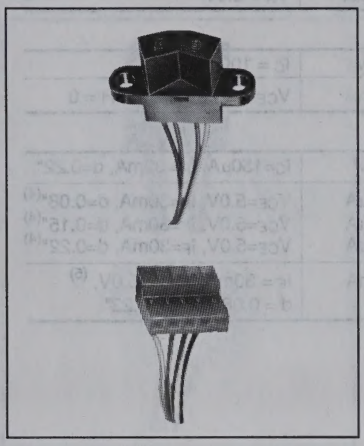


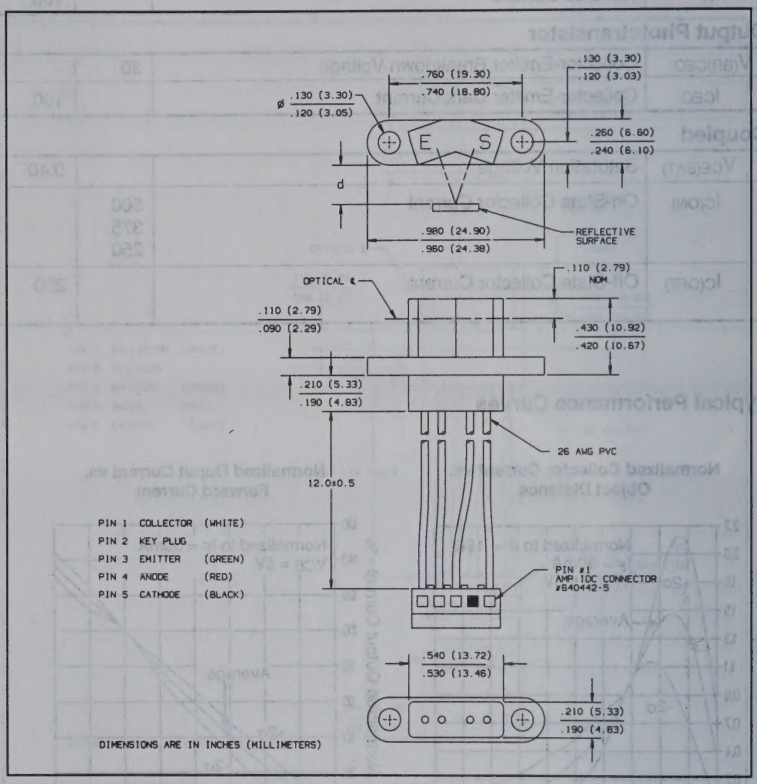

**Normalized Ouput Current vs. Forward Current**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Reflective Object Sensor
## Type OPB755T






### Features

- High contrast ratio, 1000 to 1 minimum
- 12.0" ± .05" min. UL#1429 26 AWG wire leads terminated into an AMP #640442-5 connector
- Low cost plastic housing

### Description

The OPB755T reflective assemby features a phototransistor output designed to decrease low-level light gain while not affecting the high-level light gain. Available without mounting tabs as OPB755N.

Available with PC Board mountable leads as OPB750 series. Logic output sensors available in the OPB760/OPB770 series.

### Replaces

KR100W

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +80°C |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 100mW(1) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Collector DC Current | 30mA |
| Power Dissipation | 100mW(1) |

**Notes:**
(1) Derate Linearly 1.82mW/°C above 25°C.
(2) All parameters tested using pulse technique.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) Photocurrent is measured using an Eastman Kodak Neutral White test card having a 90% diffuse reflectance as a reflecting surface.
(5) $I_{C(OFF)}$ is the photocurrent measured with current to the input diode and a 5% reflecting surface.

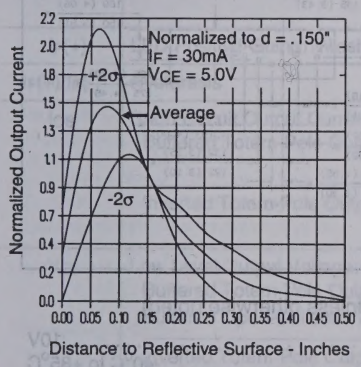
# Type OPB755T

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

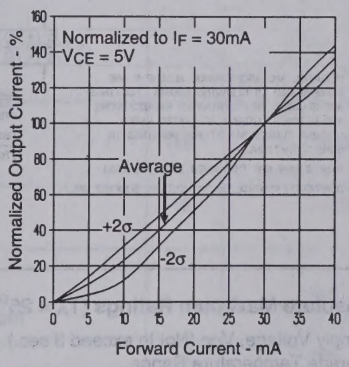
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.8 | V | $I_F$ = 40mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, H = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | | 0.40 | V | $I_C$=150µA, $I_F$= 30mA, d=0.22" |
| $I_{C(ON)}$ | On-State Collector Current | 500<br>375<br>250 | | µA<br>µA<br>µA | $V_{CE}$=5.0V, $I_F$=30mA, d=0.08"(4)<br>$V_{CE}$=5.0V, $I_F$=30mA, d=0.15"(4)<br>$V_{CE}$=5.0V, $I_F$=30mA, d=0.22"(4) |
| $I_{C(OFF)}$ | Off-State Collector Current | | 250 | nA | $I_F$ = 30mA, $V_{CE}$ = 5.0V, (5)<br>d = 0.08", 0.15", 0.22" |

## Typical Performance Curves

**Normalized Collector Current vs. Object Distance**

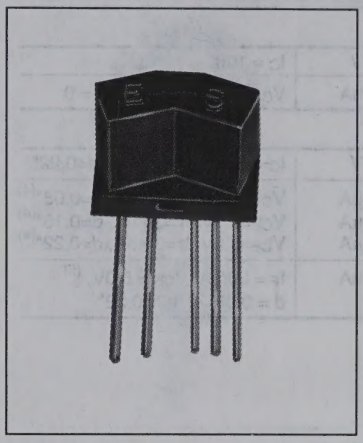


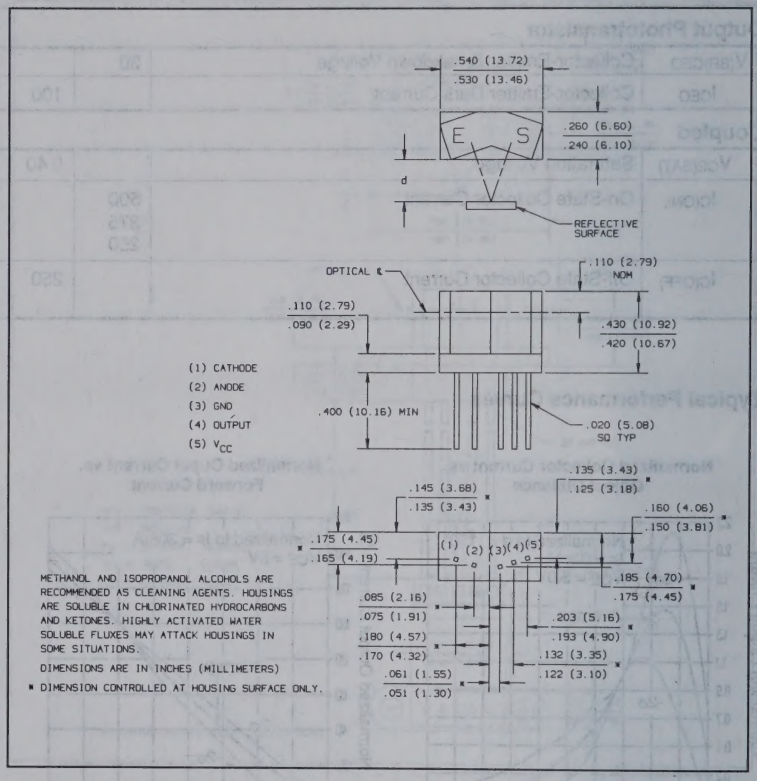

**Normalized Ouput Current vs. Forward Current**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Photologic™ Reflective Object Sensors
## Types OPB760N, OPB761N, OPB762N, OPB763N






### Features

- Choice of mounting configurations
- Choice of output configurations

### Description

The OPB760N series of reflective assemblies feature Photologic™ output. This electrical output can be specified as either TTL Totem Pole or TTL Open Collector. Either may be supplied with inverter or buffer output polarity. All have the added stability of a built-in hysteresis amplifier.

### Mounting Options

OPB760N series PC board mount, without mounting tabs

OPB760T series PC board mount, with two mounting tabs

OPB770N series wire leads with connector, without mounting tabs

OPB770T series wire leads with connector, with two mounting tabs

### Replaces

| | |
|---|---|
| OPB760N | KLR305 |
| OPB761N | KLR315 |
| OPB762N | KLR325 |
| OPB763N | KLR335 |

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (Not to exceed 3 sec.) | 10V |
| Storage Temperature Range | -40°C to +85°C |
| Operating Temperature Range | -40°C to +70°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |
| Input Diode Power Dissipation | 100mW(2) |
| Output Photologic™ Power Dissipation | 200mW(3) |
| Total Device Power Dissipation | 300mW(4) |
| Voltage at Output Lead (Open Collector Output) | 35V |
| Diode Forward D.C. Current | 40mA |
| Diode Reverse D.C. Voltage | 3V |

**Notes:**

(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.22mW/°C above 25°C.
(3) Derate linearly 4.44mW/°C above 25°C.
(4) Derate linearly 6.66mW/°C above 25°C.
(5) The OPB760N thru OPB763N series are terminated with .020" square leads designed for printed circuit board mounting.
(6) Normal application would be with light source blocked, simulated by $I_F$ = 0mA.
(7) Tested at d = 0.080" from a 90% diffuse white test surface.
(8) Tested at d = 0.080", 0.150" and 0.220" from a 90% diffuse white test surface.
(9) Tested at d = 0.080", 0.150" and 0.220" from a 5% diffuse black test surface.
(10) All parameters tested using pulse technique.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB760N, OPB761N, OPB762N, OPB763N

**Electrical Characteristics** ($T_A$ = -40°C to +70°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.8 | V | $I_F$ = 40mA, $T_A$ = 25°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V, $T_A$ = 25°C |
| **Output Photologic™ Sensor** | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | 4.75 | | 5.25 | V | |
| $I_{CCL}$ | Low Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(6)(7)<br>Output Open |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 25mA(7)<br>Output Open |
| $I_{CCH}$ | High Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 25mA(7)<br>Output Open |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(6)(7)<br>Output Open |
| $I_{OH}$ | High Level Output Voltage:<br>Buffered Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V<br>$I_F$ = 25mA, $T_A$ = 25°C |
| | Inverted Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V,<br>$I_F$ = 0mA, $T_A$ = 25°C |
| $I_{F(+)}$ | LED Positive-Going Threshold Current | | | 25 | mA | $V_{CC}$ = 5.0V, $T_A$ = 25°C(8) |
| $I_{F(+)}/I_{F(-)}$ | Hysteresis | | 1.5 | | | $V_{CC}$ = 5.0V(8) |
| $I_{OS}$ | Short Circuit Output Current:<br>Buffered Totem-Pole Output | -15 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 25mA(7)<br>Output = GND |
| | Inverted Totem-Pole Output | -15 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(7)<br>Output = GND |
| $V_{OL}$ | Low Level Output Voltage:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 0mA(6)(7) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 25mA(6)(7) |
| $V_{OL}$ | Low Level Output Voltage:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 30mA(9) |
| $V_{OH}$ | High Level Output Voltage:<br>Buffered Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA<br>$I_F$ = 25mA(7) |
| | Inverted Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA<br>$I_F$ = 0mA(6)(7) |
| $V_{OH}$ | High Level Output Voltage:<br>Inverted Totem-Pole Output<br>Inverted Open-Collector Output | 2.4 | | | V | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA<br>$I_F$ = 30mA(9) |

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Types OPB760, OPB770 Series

## PART NUMBER GUIDE

OPB 7 X X X

Optek Assembly

Photologic™
Photo Integrated Circuit
Reflective Sensor Family

6 - PC Board Mounting

7 - Wire Leads with Connector

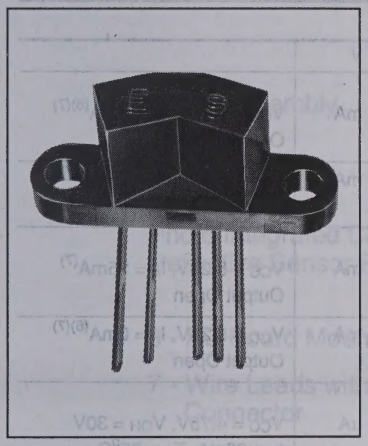
Mounting Configurations

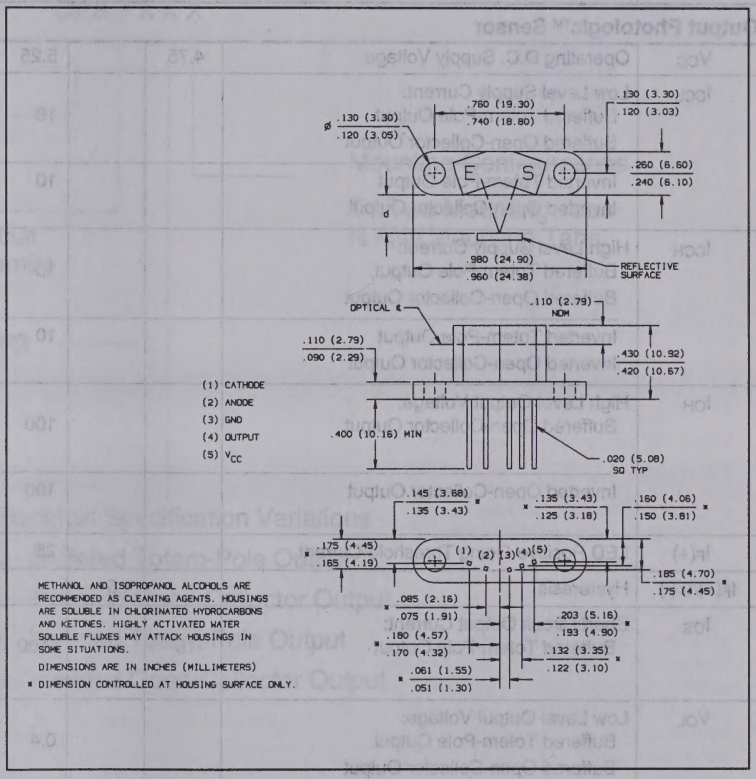
T - Two Mounting Tabs
N - No Mounting Tabs

Electrical Specification Variations

0 - Buffered Totem-Pole Output
1 - Buffered Open-Collector Output
2 - Inverted Totem-Pole Output
3 - Inverted Open-Collector Output

# Photologic™ Reflective Object Sensors
## Types OPB760T, OPB761T, OPB762T, OPB763T






### Features

- Choice of mounting configurations
- Choice of output configurations

### Description

The OPB760T series of reflective assemblies feature Photologic™ output. This electrical output can be specified as either TTL Totem Pole or TTL Open Collector. Either may be supplied with inverter or buffer output polarity. All have the added stability of a built-in hysteresis amplifier.

### Mounting Options

OPB760N series PC board mount, without mounting tabs
OPB760T series PC board mount, with two mounting tabs
OPB770N series wire leads with connector, without mounting tabs
OPB770T series wire leads with connector, with two mounting tabs

### Replaces

| | |
|---|---|
| OPB760T | KLR300 |
| OPB761T | KLR310 |
| OPB762T | KLR320 |
| OPB763T | KLR330 |

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (Not to exceed 3 sec.) | 10V |
| Storage Temperature Range | -40°C to +85°C |
| Operating Temperature Range | -40°C to +70°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |
| Input Diode Power Dissipation | 100mW(2) |
| Output Photologic™ Power Dissipation | 200mW(3) |
| Total Device Power Dissipation | 300mW(4) |
| Voltage at Output Lead (Open Collector Output) | 35V |
| Diode Forward D.C. Current | 40mA |
| Diode Reverse D.C. Voltage | 3V |

**Notes:**

(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.22mW/°C above 25°C.
(3) Derate linearly 4.44mW/°C above 25°C.
(4) Derate linearly 6.66mW/°C above 25°C.
(5) The OPB760T thru OPB763T series are terminated with .020" square leads designed for printed circuit board mounting.
(6) Normal application would be with light source blocked, simulated by $I_F$ = 0mA.
(7) Tested at d = 0.080" from a 90% diffuse white test surface.
(8) Tested at d = 0.080", 0.150" and 0.220" from a 90% diffuse white test surface.
(9) Tested at d = 0.080", 0.150" and 0.220" from a 5% diffuse black test surface.
(10) All parameters tested using pulse technique.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB760T, OPB761T, OPB762T, OPB763T

**Electrical Characteristics** ($T_A$ = -40°C to +70°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.8 | V | $I_F$ = 40mA, $T_A$ = 25°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V, $T_A$ = 25°C |
| **Output Photologic™ Sensor** | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | 4.75 | | 5.25 | V | |
| $I_{CCL}$ | Low Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(6)(7)<br>Output Open |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 25mA(7)<br>Output Open |
| $I_{CCH}$ | High Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 25mA(7)<br>Output Open |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(6)(7)<br>Output Open |
| $I_{OH}$ | High Level Output Voltage:<br>Buffered Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V<br>$I_F$ = 25mA, $T_A$ = 25°C |
| | Inverted Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V,<br>$I_F$ = 0mA, $T_A$ = 25°C |
| $I_F(+)$ | LED Positive-Going Threshold Current | | | 25 | mA | $V_{CC}$ = 5.0V, $T_A$ = 25°C(8) |
| $I_F(+)/I_F(-)$ | Hysteresis | | 1.5 | | | $V_{CC}$ = 5.0V(8) |
| $I_{OS}$ | Short Circuit Output Current:<br>Buffered Totem-Pole Output | -15 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 25mA(7)<br>Output = GND |
| $V_{OL}$ | Low Level Output Voltage:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 0mA(6)(7) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 25mA(6)(7) |
| $V_{OL}$ | Low Level Output Voltage:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 30mA(9) |
| $V_{OH}$ | High Level Output Voltage:<br>Buffered Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA<br>$I_F$ = 25mA(7) |
| | Inverted Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA<br>$I_F$ = 0mA(6)(7) |
| $V_{OH}$ | High Level Output Voltage:<br>Inverted Totem-Pole Output<br>Inverted Open-Collector Output | 2.4 | | | V | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA<br>$I_F$ = 30mA(9) |

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Types OPB760, OPB770 Series

## PART NUMBER GUIDE

OPB 7 X X X

Optek Assembly

Photologic™
Photo Integrated Circuit
Reflective Sensor Family

6 - PC Board Mounting

7 - Wire Leads with Connector

Mounting Configurations

T - Two Mounting Tabs
N - No Mounting Tabs

Electrical Specification Variations

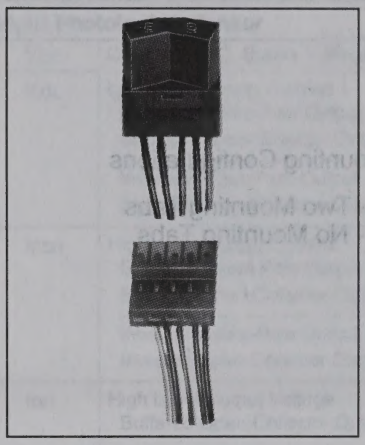
0 - Buffered Totem-Pole Output

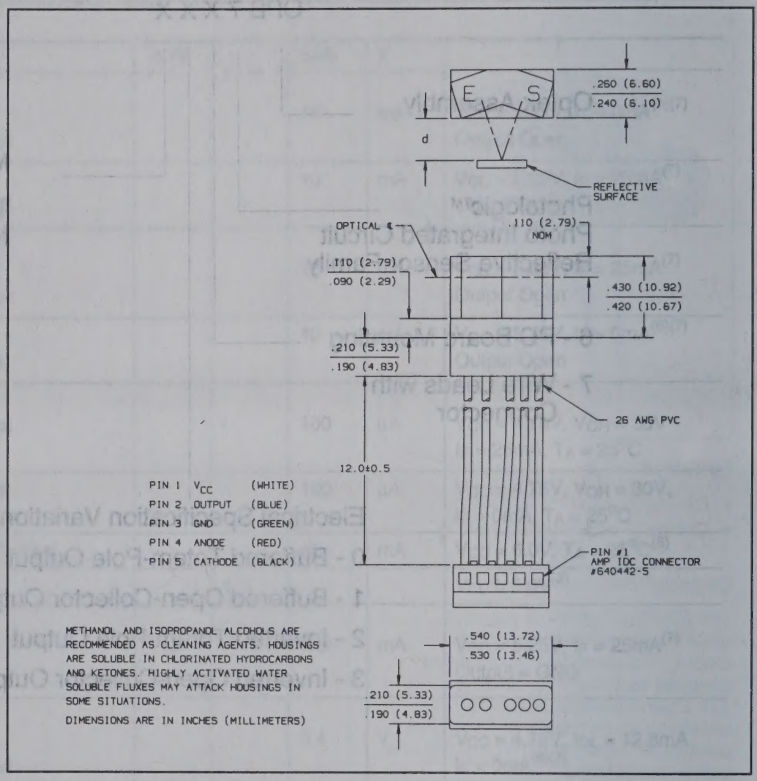
1 - Buffered Open-Collector Output

2 - Inverted Totem-Pole Output

3 - Inverted Open-Collector Output

# Photologic™ Reflective Object Sensors
## Types OPB770N, OPB771N, OPB772N, OPB773N






### Features

- Choice of mounting configurations
- Choice of output configurations

### Description

The OPB770N series of reflective assemblies feature Photologic™ output. This electrical output can be specified as either TTL Totem Pole or TTL Open Collector. Either may be supplied with inverter or buffer output polarity. All have the added stability of a built-in hysteresis amplifier.

### Mounting Options

OPB760N series PC board mount, without mounting tabs
OPB760T series PC board mount, with two mounting tabs
OPB770N series wire leads with connector, without mounting tabs
OPB770T series wire leads with connector, with two mounting tabs

### Replaces

| | |
|---|---|
| OPB770N | KLR305W |
| OPB771N | KLR315W |
| OPB772N | KLR325W |
| OPB773N | KLR335W |

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (Not to exceed 3 sec.) | 10V |
| Storage Temperature Range | -40°C to +85°C |
| Operating Temperature Range | -40°C to +70°C |
| Input Diode Power Dissipation | 100mW(1) |
| Output Photologic™ Power Dissipation | 200mW(2) |
| Total Device Power Dissipation | 300mW(3) |
| Voltage at Output Lead (Open Collector Output) | 35V |
| Diode Forward D.C. Current | 40mA |
| Diode Reverse D.C. Voltage | 3V |

**Notes:**
(1) Derate linearly 2.22mW/°C above 25°C.
(2) Derate linearly 4.44mW/°C above 25°C.
(3) Derate linearly 6.66mW/°C above 25°C.
(4) The OPB770N thru OPB773N series are terminated with 12 inches of 7 strand 26AWG, UL1429 insulated wire on each terminal. A standard AMP No. 640442-5 connector has been attached to the lead wires to ease connection to wire harnesses.
(5) Normal application would be with light source blocked, simulated by $I_F$ = 0mA.
(6) Tested at d = 0.080" from a 90% diffuse white test surface.
(7) Tested at d = 0.080", 0.150" and 0.220" from a 90% diffuse white test surface.
(8) Tested at d = 0.080", 0.150" and 0.220" from a 5% diffuse black test surface.
(9) All parameters tested using pulse technique.

# Types OPB770N, OPB771N, OPB772N, OPB773N

**Electrical Characteristics** ($T_A$ = -40°C to +70°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.8 | V | $I_F$ = 40mA, $T_A$ = 25°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V, $T_A$ = 25°C |
| **Output Photologic™ Sensor** | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | 4.75 | | 5.25 | V | |
| $I_{CCL}$ | Low Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(5)(6)<br>Output Open |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 25mA(6)<br>Output Open |
| $I_{CCH}$ | High Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 25mA(6)<br>Output Open |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(5)(6)<br>Output Open |
| $I_{OH}$ | High Level Output Voltage:<br>Buffered Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V<br>$I_F$ = 25mA, $T_A$ = 25°C |
| | Inverted Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V,<br>$I_F$ = 0mA, $T_A$ = 25°C |
| $I_{F(+)}$ | LED Positive-Going Threshold Current | | | 25 | mA | $V_{CC}$ = 5.0V, $T_A$ = 25°C(7) |
| $I_{F(+)}/I_{F(-)}$ | Hysteresis | | 1.5 | | | $V_{CC}$ = 5.0V(7) |
| $I_{OS}$ | Short Circuit Output Current:<br>Buffered Totem-Pole Output | -15 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 25mA(6)<br>Output = GND |
| | Inverted Totem-Pole Output | -15 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(6)<br>Output = GND |
| $V_{OL}$ | Low Level Output Voltage:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 0mA(5)(6) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 25mA(5)(6) |
| $V_{OL}$ | Low Level Output Voltage:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 30mA(8) |
| $V_{OH}$ | High Level Output Voltage:<br>Buffered Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA<br>$I_F$ = 25mA(6) |
| | Inverted Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA<br>$I_F$ = 0mA(5)(6) |
| $V_{OH}$ | High Level Output Voltage:<br>Inverted Totem-Pole Output<br>Inverted Open-Collector Output | 2.4 | | | V | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA<br>$I_F$ = 30mA(8) |

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Types OPB760, OPB770 Series

## PART NUMBER GUIDE

OPB 7 X X X

Optek Assembly

Photologic™
Photo Integrated Circuit
Reflective Sensor Family

6 - PC Board Mounting

7 - Wire Leads with Connector

Mounting Configurations

T - Two Mounting Tabs
N - No Mounting Tabs

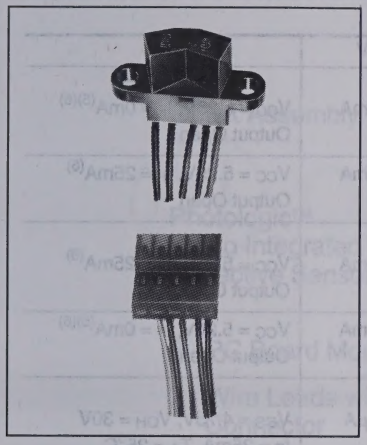
Electrical Specification Variations

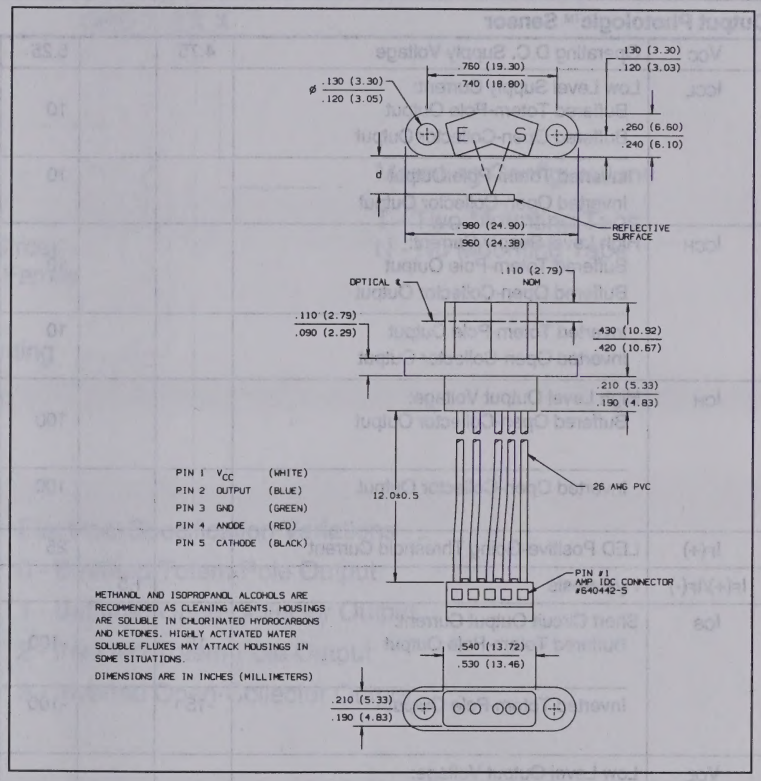
0 - Buffered Totem-Pole Output
1 - Buffered Open-Collector Output
2 - Inverted Totem-Pole Output
3 - Inverted Open-Collector Output

OPTEK



# Photologic™ Reflective Object Sensors
## Types OPB770T, OPB771T, OPB772T, OPB773T






### Features

- Choice of mounting configurations
- Choice of output configurations

### Description

The OPB770T series of reflective assemblies feature Photologic™ output. This electrical output can be specified as either TTL Totem Pole or TTL Open Collector. Either may be supplied with inverter or buffer output polarity. All have the added stability of a built-in hysteresis amplifier.

### Mounting Options

OPB760N series PC board mount, without mounting tabs
OPB760T series PC board mount, with two mounting tabs
OPB770N series wire leads with connector, without mounting tabs
OPB770T series wire leads with connector, with two mounting tabs

### Replaces

| | |
|---|---|
| OPB770T | KLR300W |
| OPB771T | KLR310W |
| OPB772T | KLR320W |
| OPB773T | KLR330W |

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (Not to exceed 3 sec.) | 10V |
| Storage Temperature Range | -40°C to +85°C |
| Operating Temperature Range | -40°C to +70°C |
| Input Diode Power Dissipation | 100mW(1) |
| Output Photologic™ Power Dissipation | 200mW(2) |
| Total Device Power Dissipation | 300mW(3) |
| Voltage at Output Lead (Open Collector Output) | 35V |
| Diode Forward D.C. Current | 40mA |
| Diode Reverse D.C. Voltage | 3V |

**Notes:**
(1) Derate linearly 2.22mW/°C above 25°C.
(2) Derate linearly 4.44mW/°C above 25°C.
(3) Derate linearly 6.66mW/°C above 25°C.
(4) The OPB770T thru OPB773T series are terminated with 12 inches of 7 strand 26AWG, UL1429 insulated wire on each terminal. A standard AMP No. 640442-5 connector has been attached to the lead wires to ease connection to wire harnesses.
(5) Normal application would be with light source blocked, simulated by $I_F$ = 0mA.
(6) Tested at d = 0.080" from a 90% diffuse white test surface.
(7) Tested at d = 0.080", 0.150" and 0.220" from a 90% diffuse white test surface.
(8) Tested at d = 0.080", 0.150" and 0.220" from a 5% diffuse black test surface.
(9) All parameters tested using pulse technique.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB770T, OPB771T, OPB772T, OPB773T

**Electrical Characteristics** ($T_A$ = -40°C to +70°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.8 | V | $I_F$ = 40mA, $T_A$ = 25°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V, $T_A$ = 25°C |
| **Output Photologic™ Sensor** | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | 4.75 | | 5.25 | V | |
| $I_{CCL}$ | Low Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(5)(6)<br>Output Open |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 25mA(6)<br>Output Open |
| $I_{CCH}$ | High Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 25mA(6)<br>Output Open |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 10 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(5)(6)<br>Output Open |
| $I_{OH}$ | High Level Output Voltage:<br>Buffered Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V<br>$I_F$ = 25mA, $T_A$ = 25°C |
| | Inverted Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V,<br>$I_F$ = 0mA, $T_A$ = 25°C |
| $I_F(+)$ | LED Positive-Going Threshold Current | | | 25 | mA | $V_{CC}$ = 5.0V, $T_A$ = 25°C(7) |
| $I_F(+)/I_F(-)$ | Hysteresis | | 1.5 | | | $V_{CC}$ = 5.0V(7) |
| $I_{OS}$ | Short Circuit Output Current:<br>Buffered Totem-Pole Output | -15 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 25mA(6)<br>Output = GND |
| | Inverted Totem-Pole Output | -15 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(6)<br>Output = GND |
| $V_{OL}$ | Low Level Output Voltage:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 0mA(5)(6) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 25mA(5)(6) |
| $V_{OL}$ | Low Level Output Voltage:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 30mA(8) |
| $V_{OH}$ | High Level Output Voltage:<br>Buffered Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA<br>$I_F$ = 25mA(6) |
| | Inverted Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA<br>$I_F$ = 0mA(5)(6) |
| $V_{OH}$ | High Level Output Voltage:<br>Inverted Totem-Pole Output<br>Inverted Open-Collector Output | 2.4 | | | V | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA<br>$I_F$ = 30mA(8) |

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# PART NUMBER GUIDE

OPB 7 X X X

Optek Assembly

Photologic™
Photo Integrated Circuit
Reflective Sensor Family

6 - PC Board Mounting

7 - Wire Leads with Connector

Mounting Configurations

T - Two Mounting Tabs
N - No Mounting Tabs

Electrical Specification Variations

0 - Buffered Totem-Pole Output
1 - Buffered Open-Collector Output
2 - Inverted Totem-Pole Output
3 - Inverted Open-Collector Output

OPTEK TECHNOLOGY, INC.®

# SLOTTED OPTICAL SWITCHES

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Slotted Optical Switches

Slotted optical switches, also known as transmissive assemblies or gap switches, are motion or position sensors. They operate on the principle that an object opaque to infrared light transmission will block light in the path between an infrared emitting diode (IRED) and a photosensor.

Slotted optical switches provide non-contact sensing of linear or rotary motion as in optical encoders. They find a variety of uses in industrial controls, computer peripherals and other instrumentation. They can signal:

- conveyor feed rates
- door positions on disk drives
- end-of-carriage return on data processing printers
- seating of tape cartridges

and they have many more applications.

An Optek slotted switch consists of an IRED and a silicon photosensor, each mounted on opposite sides of a slot in a molded plastic housing. When the gap is open or when material transparent to IR transmission passes through the slot, light reaches the photosensor allowing it to conduct current and the switch is "on." When an object opaque to IR transmission passes through the slot, the IR transmission is blocked, the photosensor does not conduct, and the switch is "off."

The speed of the switch is often an important application consideration. The overall switching time depends on the device chosen to serve as the photosensor. For example, a photodarlington switches in milliseconds; a phototransistor, in microseconds; and an Optek Photologic™ device (which is a photo-integrated circuit) in the low nanosecond range. In many designs, the mechanical turn-off and turn-on times for the equipment being controlled are much longer than the switching times of the photosensor.

## Position Sensors

These sensors are electromechanical devices that detect the position or rate of change of position of a mechanism and translate the monitored information into useful output. A good example is the tachometer, which is a rotary encoder sensing slots in a wheel. The switch produces a pulse for every slot on the wheel. The number of pulses versus time provides a readout of the motor speed.

Standard switches can easily read 0.010 inch widths in etched metal or molded plastic disks. Typically, the slots are rectangular in shape. Maximum resolution is achieved by the narrowest of detectable apertures. Designs calling for narrower apertures than 0.010 inches are possible but may require custom designed and higher priced switches.

Application Bulletin 206, printed in this data book, discusses linear and rotary encoders in depth. Application Bulletins 203 and 209 discuss specific Optek interruptive assemblies for encoding and other functions.

## Housing Material and Other Considerations

Housings for slotted optical switches do two things: they hold the IRED and photosensor in permanent fixed positions, and they contain mounting holes or other means of attachment to the equipment. The materials most commonly used for Optek slotted optical switch housings are polycarbonate and polysulfone, although other plastics may be used for specific applications. Injection molding techniques are used to form the plastic housing.

For applications that require special materials for the housings, Optek can custom design a housing part to match exact specifications.

## Options for Selecting A Slotted Optical Switch

Design considerations of speed, resolution, length of optical path, environment, performance and cost impinge upon the proper selection of interruptive assemblies. Optek offers the engineer a wide selection of assemblies to meet exact design requirements. Optek offers slotted optical switches with the following options:

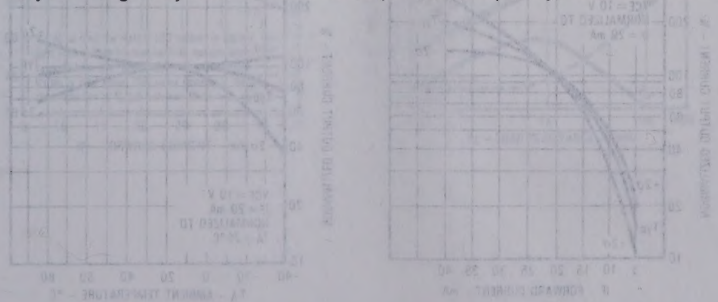
1. Phototransistor, photodarlington or Photologic™ output.
   a. Phototransistor output in various output ranges.
   b. Photologic™ output in four different output variations.
2. Gallium arsenide or gallium aluminum arsenide IREDs.
3. Dual channel devices in side-by-side or over/under configuration for speed, direction of movement and relative position sensing.
4. Various slot widths and depths.
5. Different sensor and emitter lead spacings.
6. Different aperture widths in front of sensor and emitter.
7. Different mounting configurations and housing styles.
8. Housing materials: opaque or transmissive .
9. Lead wires and connectors: standard leads of 24" (minimum length).

## Typical Applications

- Printers
- Electric watt-hour meters
- Copying machines
- Coin changers
- Disk drives
- Medical equipment
- Paper sorting equipment
- Typewriters
- Amusement games
- Liquid level sensing equiment
- Touch panel applications

## Custom Design of Interruptive Assemblies

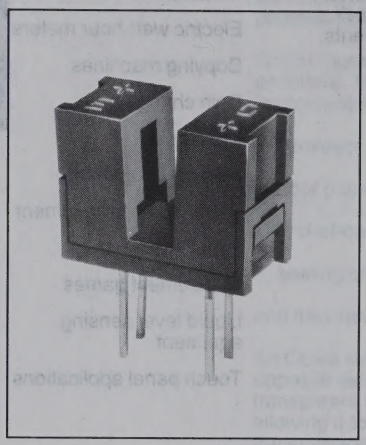
In cases where unique specifications call for a custom design, Optek can work closely with the customer to produce the optimum interruptive slotted optical switch. Such designs can vary from slight adjustments to standard parts to completely new mechanical configurations.

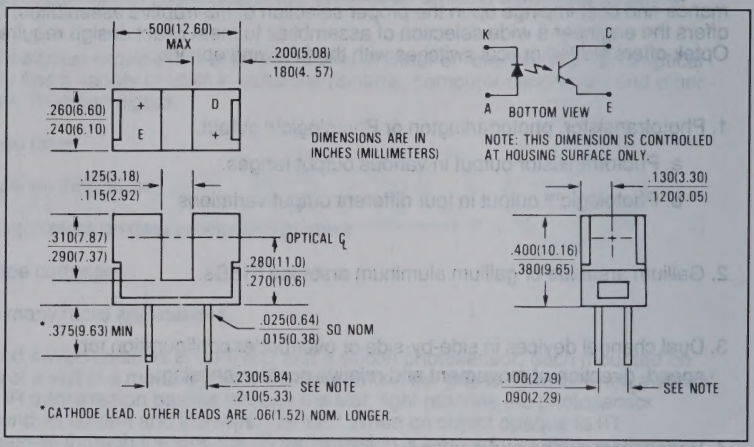


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Slotted Optical Switch
## Type CNY36

Not recommended for new design. See OPB860






### Features

- Non-contact switching
- Printed circuit board mounting
- 0.120" wide slot
- 0.220" lead spacing

### Description

The CNY36 consists of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost plastic housing on opposite sides of a 0.120" (3.05mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Input Diode**

| | |
|---|---|
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse Voltage | 2.0V |
| Power Dissipation | 100mW(2) |

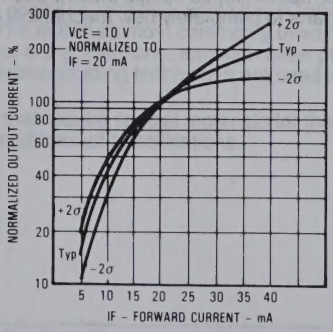
**Output Phototransistor**

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 100mW(2) |

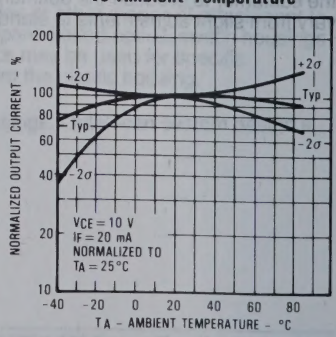
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

### Typical Performance Curves

**Normalized Output Current vs Forward Current**




**Normalized Output Current vs Ambient Temperature**



# Type CNY36

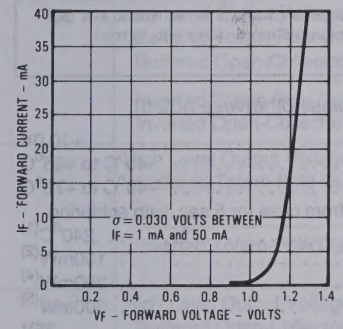
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.50 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 1.00mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.40 | V | $I_C$ = 25µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | Collector Current | 200 | | µA | $V_{CE}$ = 10.0V, $I_F$ = 20mA |

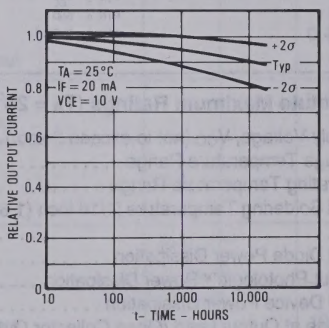


## Typical Performance Curves

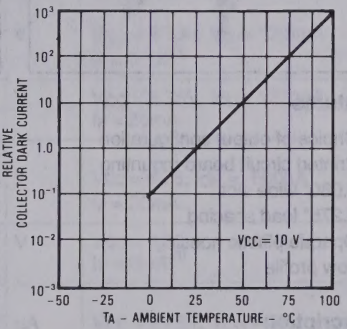
**Forward Current vs Forward Voltage Input Diode**



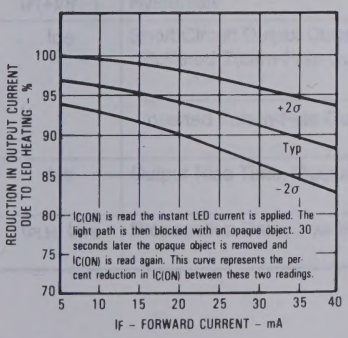

**Relative Output Current vs Time**



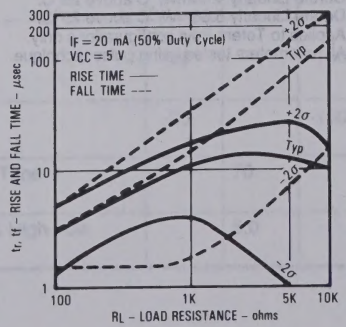

**Relative Collector Dark Current vs Ambient Temperature**




**Reduction in Output Current Due to LED Heating vs Forward Current**


REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
IF - FORWARD CURRENT - mA

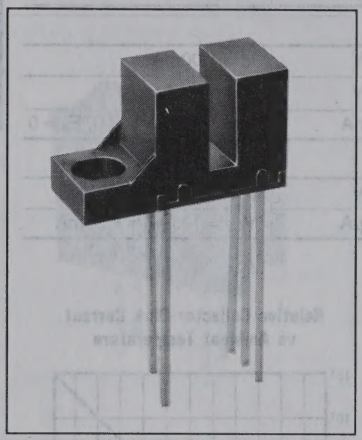
**Rise and Fall Time vs vs Load Resistance**

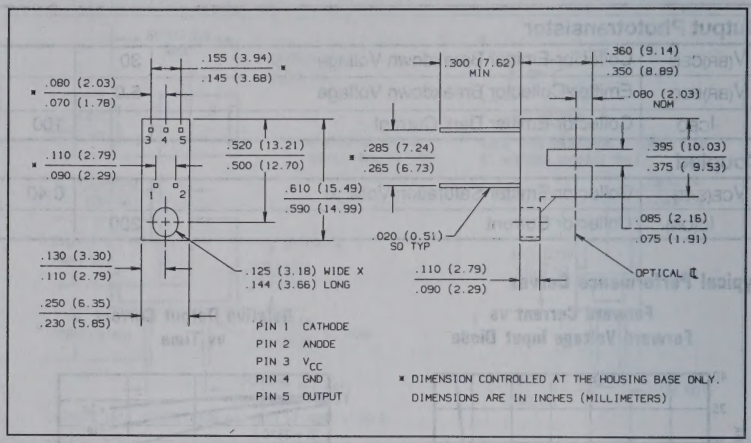



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Photologic™ Slotted Optical Switches
## Types OPB120A, OPB121A, OPB122A, OPB123A






### Features

- Choice of output configuration
- Printed circuit board mounting
- 0.080" wide slot
- 0.275" lead spacing
- Opaque plastic housing
- Low profile

### Description

The OPB120A through OPB123A each consist of an infrared emitting diode and a Photologic™ sensor (a monolithic integrated circuit which incorporates a linear amplifier and a Schmitt Trigger) mounted on opposite sides of a .080" wide gap opaque housing, with molded .040" wide apertures located over both emitter and Photologic™ sensor.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (not to exceed 3 sec.) | +10.0V |
| Storage Temperature Range | -40°C to +85°C |
| Operating Temperature Range | -40°C to +70°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |
| Input Diode Power Dissipation | 100mW(2) |
| Output Photologic™ Power Dissipation | 200mW(4) |
| Total Device Power Dissipation | 300mW(5) |
| Voltage at Output Lead (Open Collector Output) | 35V |
| Forward D.C. Current | 40mA |
| Reverse D.C. Voltage | 2.0V |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 2.22mW/°C above 25°C.
(3) Normal application would be with light source blocked, simulated by $I_F$ = 0.
(4) Derate Linearly 4.44mW/°C above 25°C.
(5) Derate Linearly 6.66mW/°C above 25°C.
(6) Applies to Totem Pole configurations only.
(7) All parameters tested using pulse technique.

# Types OPB120A, OPB121A, OPB122A, OPB123A

**Electrical Characteristics** ($T_A$ = -40°C to +70°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20mA, $T_A$ = 25°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V, $T_A$ = 25°C |
| **Output Photologic™ Sensor** | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | 4.75 | | 5.25 | V | |
| $I_{CCL}$ | Low Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(3) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 20mA |
| $I_{CCH}$ | High Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 20mA |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(3) |
| $V_{OL}$ | Low Level Output Voltage:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 0mA(3) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 20mA |
| $V_{OH}$ | High Level Output Voltage:<br>Buffered Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA<br>$I_F$ = 20mA |
| | Inverted Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA<br>$I_F$ = 0mA(3) |
| $I_{OH}$ | High Level Output Voltage:<br>Buffered Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V<br>$I_F$ = 20mA, $T_A$ = 25°C |
| | Inverted Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V,<br>$I_F$ = 0mA, $T_A$ = 25°C |
| $I_F(+)$ | LED Positive-Going Threshold Current | | | 15 | mA | $V_{CC}$ = 5.0V, $T_A$ = 25°C |
| $I_F(+)/I_F(-)$ | Hysteresis | | 2.0 | | | $V_{CC}$ = 5.0V |
| $I_{OS}$ | Short Circuit Output Current:<br>Buffered Totem-Pole Output | -20 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 20mA(6)<br>Output = GND |
| | Inverted Totem-Pole Output | -20 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(6)<br>Output = GND |
| $t_r$,$t_f$ | Output Rise Time, Output Fall Time | | 70 | | ns | $V_{CC}$ = 5.0V, $T_A$ = 25°C<br>$I_F$ = 0 or 20mA |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay Low-High & High-Low | | 5.0 | | µs | $R_L$ = 8TTL Loads (Totem Pole)<br>$R_L$ = 360Ω (Open Collector) |

SLOTTED OPTICAL SWITCHES

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

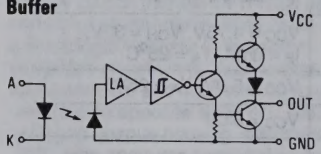
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Part Number Guide

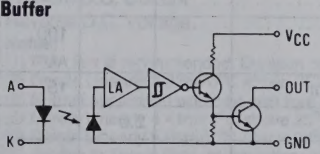
| | Output | Aperture | |
|---|---|---|---|
| | | Emitter | Sensor |
| OP120A | Buffer Totem-Pole | .040 | .040 |
| OP121A | Buffer Open-Collector | .040 | .040 |
| OP122A | Inverter Totem-Pole | .040 | .040 |
| OP123A | Inverter Open-Collector | .040 | .040 |
| OP120B | Buffer Totem-Pole | .040 | .010 |
| OP121B | Buffer Open-Collector | .040 | .010 |
| OP122B | Inverter Totem-Pole | .040 | .010 |
| OP123B | Inverter Open-Collector | .040 | .010 |

**Schematics**

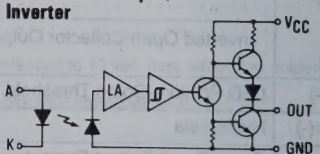
**OPB120**
**(Totem-Pole Output)**
**Buffer**



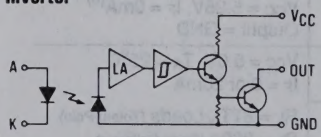

**OPB121**
**(Open-Collector Output)**
**Buffer**




**OPB122**
**(Totem-Pole Output)**
**Inverter**




**OPB123**
**(Open-Collector Output)**
**Inverter**



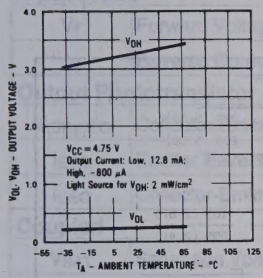

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

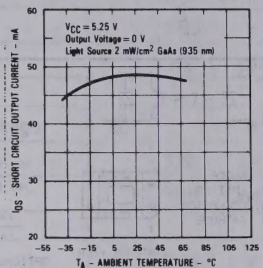
## Typical Performance Curves

### OPB120, OPB122

**Output Voltage vs Ambient Temperature**

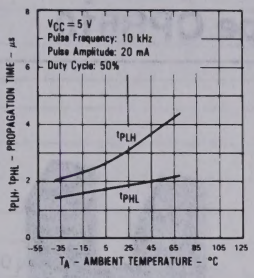

$V_{OH}$
$V_{OL}$
$V_{CC}$ = 4.75 V
Output Current: Low, 12.8 mA;
High, −800 µA
Light Source for $V_{OH}$: 2 mW/cm²
$V_{OL}$, $V_{OH}$ – OUTPUT VOLTAGE – V
$T_A$ – AMBIENT TEMPERATURE – °C

**Short Circuit Output Current vs Ambient Temperature**



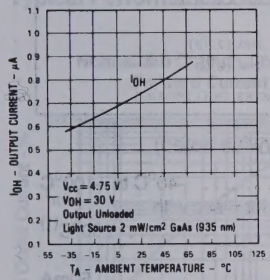

### All Assemblies

**Propagation Time vs Ambient Temperature**

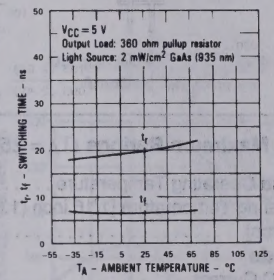



### OPB121, OPB123

**Output Current (High) vs Ambient Temperature**

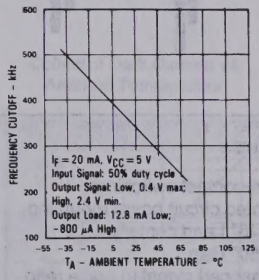



**Rise Time and Fall Time vs Ambient Temperature**


$V_{CC}$ = 5 V
Output Load: 360 ohm pullup resistor
Light Source: 2 mW/cm² GaAs (935 nm)
$t_r$
$t_f$
$t_r$, $t_f$ – SWITCHING TIME – ns
$T_A$ – AMBIENT TEMPERATURE – °C

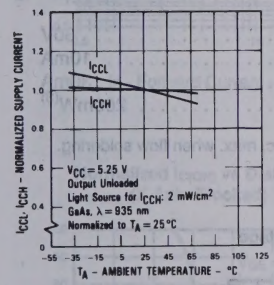
### All Assemblies

**Data Rate vs Ambient Temperature**


$I_F$ = 20 mA, $V_{CC}$ = 5 V
Input Signal: 50% duty cycle
Output Signal: Low, 0.4 V max;
High, 2.4 V min.
Output Load: 12.8 mA Low;
−800 µA High
FREQUENCY CUTOFF – kHz
$T_A$ – AMBIENT TEMPERATURE – °C

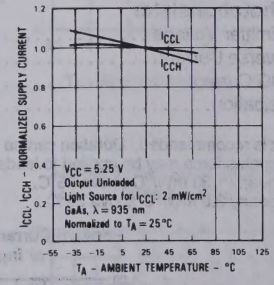
### OPB120, OPB121

**Normalized Supply Current vs Ambient Temperature**


$I_{CCL}$
$I_{CCH}$
$V_{CC}$ = 5.25 V
Output Unloaded
Light Source for $I_{CCH}$: 2 mW/cm²
GaAs, λ = 935 nm
Normalized to $T_A$ = 25°C
$I_{CCL}$, $I_{CCH}$ – NORMALIZED SUPPLY CURRENT
$T_A$ – AMBIENT TEMPERATURE – °C

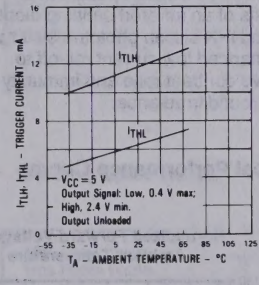
### OPB122, OPB123

**Normalized Supply Current vs Ambient Temperature**

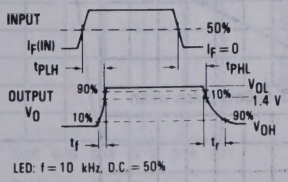

$I_{CCL}$
$I_{CCH}$
$V_{CC}$ = 5.25 V
Output Unloaded
Light Source for $I_{CCL}$: 2 mW/cm²
GaAs, λ = 935 nm
Normalized to $T_A$ = 25°C
$I_{CCL}$, $I_{CCH}$ – NORMALIZED SUPPLY CURRENT
$T_A$ – AMBIENT TEMPERATURE – °C

### All Assemblies

**Trigger Current vs Ambient Temperature**

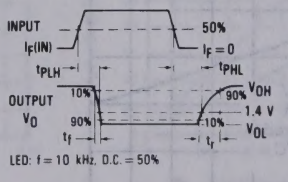



### Switching Test Curve for Buffers



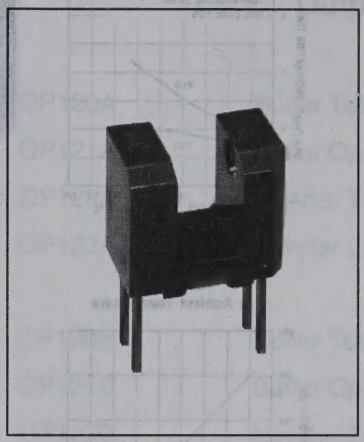

LED: f = 10 kHz, D.C. = 50%

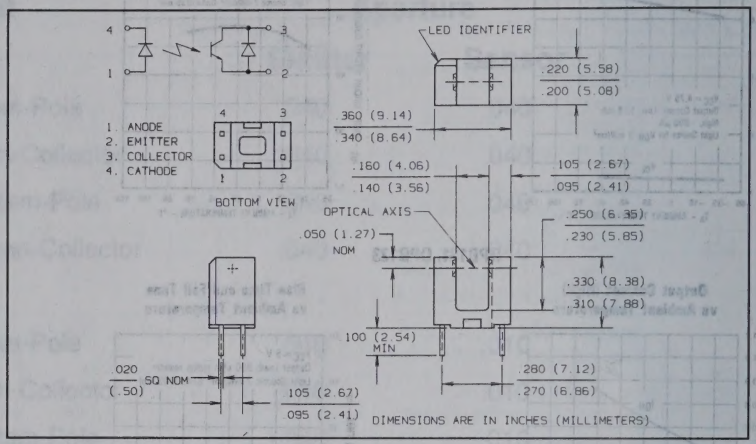
### Switching Test Curve for Inverters




LED: f = 10 kHz, D.C. = 50%

# Slotted Optical Switch
## Type OPB610






### Features

- Non-contact switching
- Printed circuit board mounting
- 0.275" Lead centers
- 0.150" Gap
- Enhanced signal to noise ratio

### Description

The OPB610 slotted optical switch consists of an infrared emitting diode and an NPN silicon phototransistor with an enhanced low current roll-off to improve contrast ratio and immunity to background irradiance.

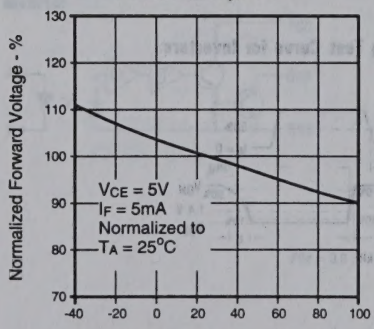
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec with soldering iron] | 260°C(1) |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 3.0V |
| Power Dissipation | 100mW(2) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter Reverse Current | 10mA |
| Collector DC Current | 30mA |
| Power Dissipation | 200mW(3) |

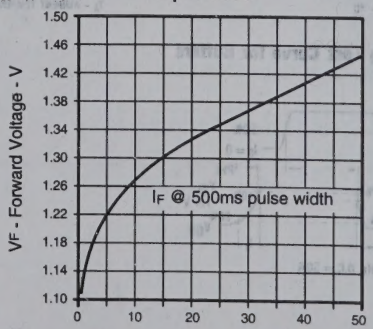
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.0 mW/°C above 25°C.

### Typical Performance Curves

**Normalized Forward Voltage vs Ambient Temperature**




**Forward Current vs Forward Voltage Input Diode**



# Types OPB610

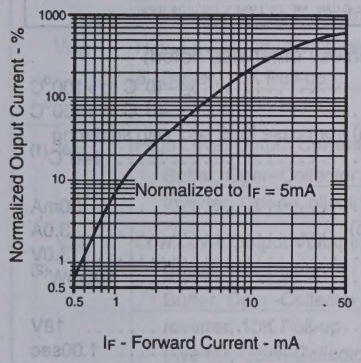
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.60 | V | $I_F$ = 10 mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 3.0 V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 100 µA |
| $I_{ECO}$ | Emitter Reverse Current | | 100 | µA | $V_{EC}$ = 0.4 V |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 5 V |
| **Coupled** | | | | | |
| $V_{SAT}$ | Saturation Voltage | | 0.40 | V | $I_F$ = 5 mA, $I_C$ = 100 µA |
| $I_{C(ON)}$ | On-State Collector Current | 1.0 | | mA | $I_F$ = 5 mA, $V_{CE}$ = 5 V |

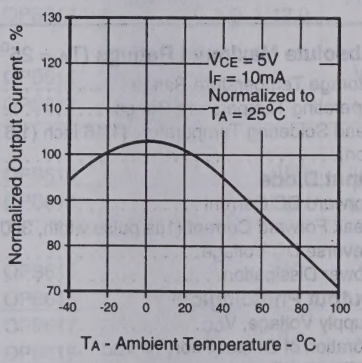
SLOTTED OPTICAL SWITCHES

## Typical Performance Curves

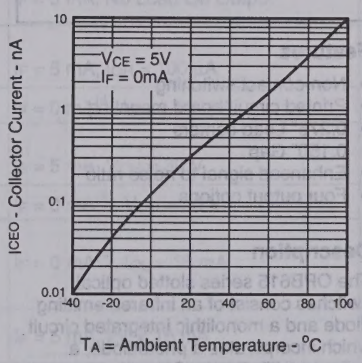
**Normalized Output Current vs Forward Current**



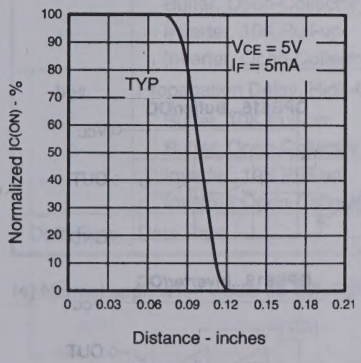

**Normalized Output Current vs Ambient Temperature**



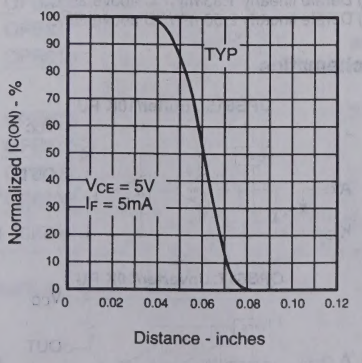

**Collector Dark Current vs Ambient Temperature**



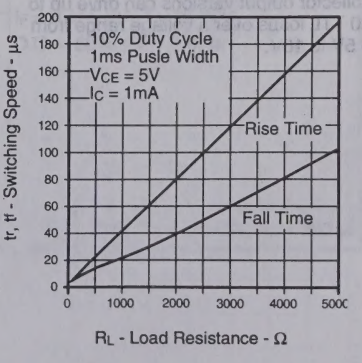

**Normalized $I_{C(ON)}$ vs Distance (X Axis Blocked)**




**Normalized $I_{C(ON)}$ vs Distance (Y Axis Blocked)**




**Switching Speed vs Load**

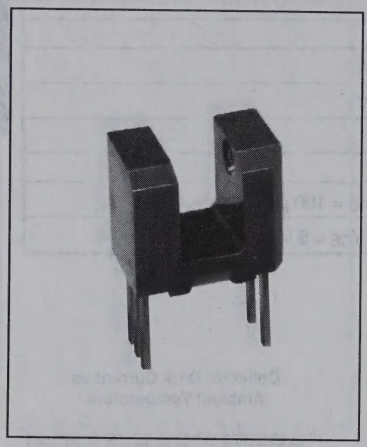


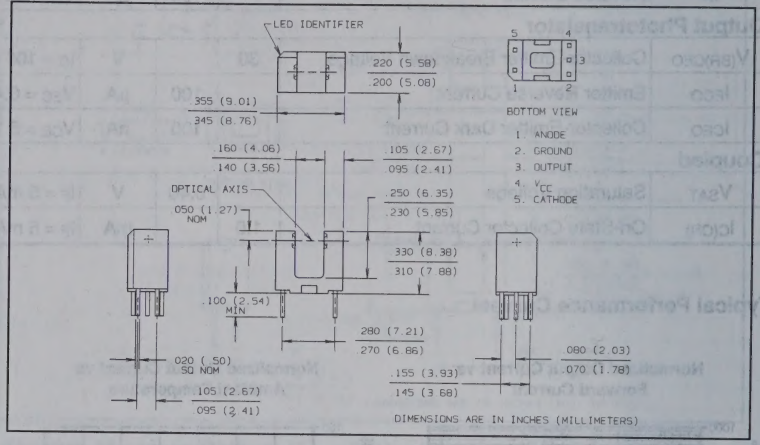

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# Photologic™ Slotted Optical Switch
## Types OPB615, OPB616, OPB617, OPB618






### Features

- Non-contact switching
- Printed circuit board mounting
- 0.275" Lead centers
- 0.150" Gap
- Enhanced signal to noise ratio
- Four output options

### Description

The OPB615 series slotted optical switches consist of an infrared emitting diode and a monolithic integrated circuit which incorporates a photodiode, a linear amplifier and a Schmitt trigger on a single silicon chip.

The sensors feature TTL/LSTTL compatible logic level output. Open collector output versions can drive up to 10 TTL loads over a voltage range from 4.5V to 16V.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature Range | -40°C to +100°C |
| Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Input Diode**

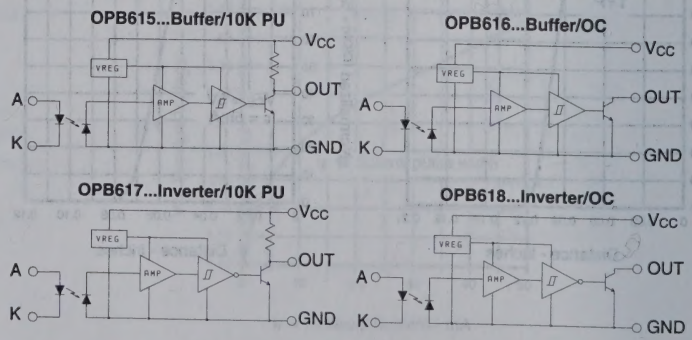
| | |
|---|---|
| Forward DC Current | 50mA |
| Peak Forward Current (1µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 3.0V |
| Power Dissipation | 100mW(2) |

**Output Photologic™**

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 18V |
| Duration of Output Short To $V_{CC}$ | 1.00sec |
| Voltage at Output | 30V |
| Low Level Output Current (sinking) | 16mA |
| Power Dissipation | 240mW(3) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.50 mW/°C above 30°C.

### Schematics



# Types OPB615, OPB616, OPB617, OPB618

**Electrical Characteristics** ($T_A$ = 25°C, $V_{CC}$ = 4.5V to 16V unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | | | 1.6 | V | $I_F$ = 10 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 3.0 V |
| **Output Photologic™ Sensor** | | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | | 4.5 | | 16.0 | V | |
| $I_F(+)$ | LED Positive-Going Threshold Current | | 0.1 | 0.55 | 3.0 | mA | |
| $I_F(+)/I_F(-)$ | Hysteresis Ratio | | 1.05 | 1.20 | 1.60 | | |
| $I_{CCH}$ | High Level Supply Current: | | | | | | |
| | Buffer, 10K Pull-up | OPB615 | | 5.0 | 12.0 | mA | $I_F$ = 5 mA, No Load On Output |
| | Buffer, Open-Collector | OPB616 | | | | | |
| | Inverter, 10K Pull-up | OPB617 | | 4.0 | 12.0 | mA | $I_F$ = 0 mA(4), No Load On Output |
| | Inverter, Open-Collector | OPB618 | | | | | |
| $I_{CCL}$ | Low Level Supply Current: | | | | | | |
| | Buffer, 10K Pull-up | OPB615 | | 5.5 | 12.0 | mA | $I_F$ = 0 mA(4), No Load On Output |
| | Buffer, Open-Collector | OPB616 | | 4.0 | 12.0 | | |
| | Inverter, 10K Pull-up | OPB617 | | 6.5 | 12.0 | mA | $I_F$ = 5 mA, No Load On Output |
| | Inverter, Open-Collector | OPB618 | | 5.0 | 12.0 | | |
| $V_{OH}$ | High Level Output Voltage: | | | | | | |
| | Buffer, 10K Pull-up | OPB615 | ($V_{CC}$-1.5) | | | V | $I_F$ = 5 mA, $I_{OH}$ = 100 µA |
| | Inverter, 10K Pull-up | OPB617 | ($V_{CC}$-1.5) | | | V | $I_F$ = 0 mA(4), $I_{OH}$ = 100 µA |
| $I_{OH}$ | High Level Output Current: | | | | | | |
| | Buffer, Open-Collector | OPB616 | | | 100 | µA | $I_F$ = 5 mA, $V_{OH}$ = 30 V |
| | Inverter, Open-Collector | OPB618 | | | 100 | µA | $I_F$ = 0 mA(4), $V_{OH}$ = 30 V |
| $V_{OL}$ | Low Level Output Voltage: | | | | | | |
| | Buffer, 10K Pull-up | OPB615 | | | 0.4 | V | $I_F$ = 0 mA(4), $I_{OL}$ = 16 mA |
| | Buffer, Open-Collector | OPB616 | | | | | |
| | Inverter, 10K Pull-up | OPB617 | | | 0.4 | V | $I_F$ = 5 mA, $I_{OL}$ = 16 mA |
| | Inverter, Open-Collector | OPB618 | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | | 30 | | ns | $I_F$ = 0 or 5 mA, f = 10 KHz, D.C. = 50%, $R_L$ = 300 Ω |
| $t_{PLH}$ | Propagation Delay, Low-High | | | | | | |
| | Buffer, 10K Pull-up | OPB615 | | 0.6 | | µs | |
| | Buffer, Open-Collector | OPB616 | | | | | |
| | Inverter, 10K Pull-up | OPB617 | | 3.0 | | µs | |
| | Inverter, Open-Collector | OPB618 | | | | | |
| $t_{PHL}$ | Propagation Delay, High-Low | | | | | | |
| | Buffer, 10K Pull-up | OPB615 | | 3.0 | | µs | |
| | Buffer, Open-Collector | OPB616 | | | | | |
| | Inverter, 10K Pull-up | OPB617 | | 0.6 | | µs | |
| | Inverter, Open-Collector | OPB618 | | | | | |
| Data Rate | Data Rate | | | 100 | | KHz | $I_F$ = 0 or 5 mA, D.C. = 50%, $R_L$ = 300 Ω |

(4) Normal application would be with light source blocked, simulated by $I_F$ = 0mA.

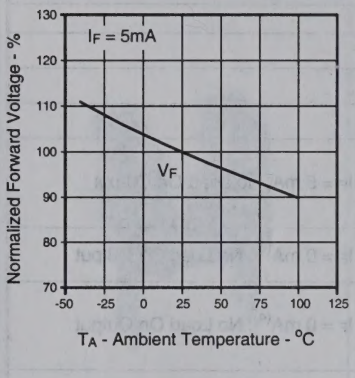


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

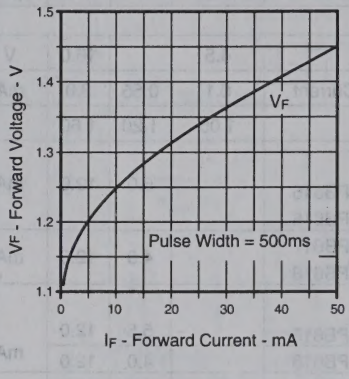
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

## Typical Performance Curves

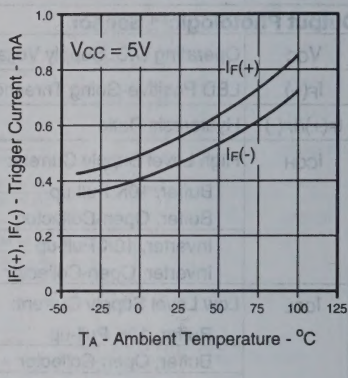
**Normalized Forward Voltage vs Ambient Temperature**



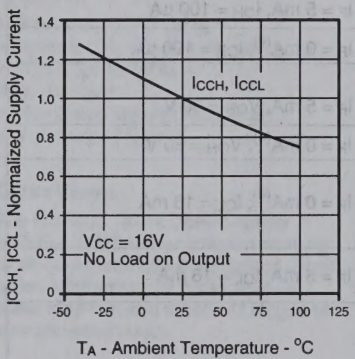

**Forward Voltage vs Forward Current Input Diode**



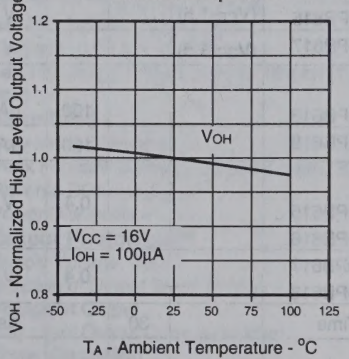

**Trigger Current vs Ambient Temperature**



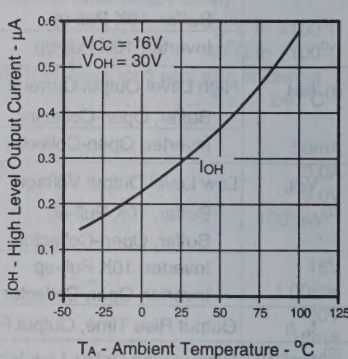

**Normalized Supply Current vs Ambient Temperature**



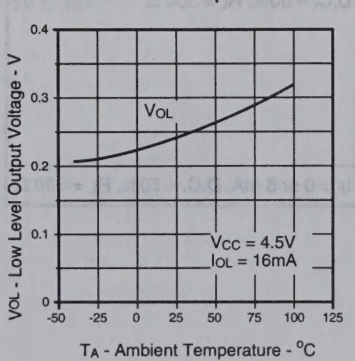

**OPB615, OPB617 Normalized High Level Output Voltage vs Ambient Temperature**



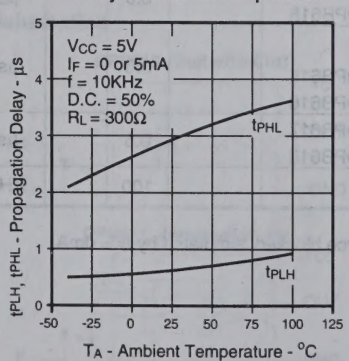

**OPB616, OPB618 High Level Output Current vs Ambient Temperature**



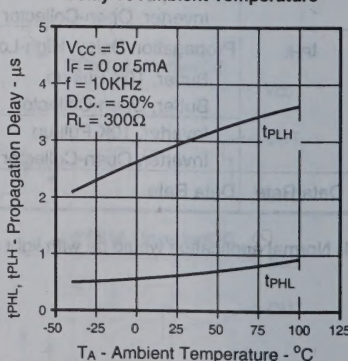

**Low Level Output Voltage vs Ambient Temperature**




**OPB615, OPB616 Propagation Delay vs Ambient Temperature**

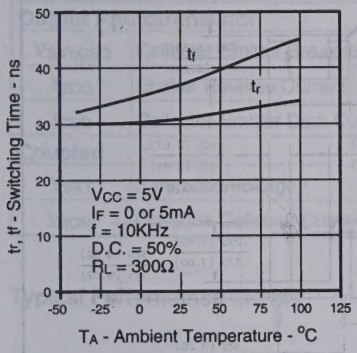



**OPB617, OPB618 Propagation Delay vs Ambient Temperature**

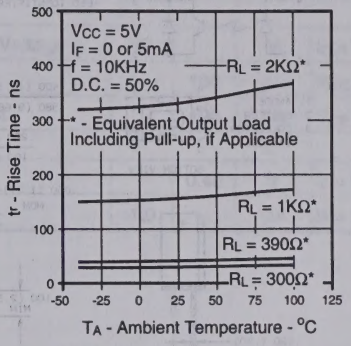


## Typical Performance Curves

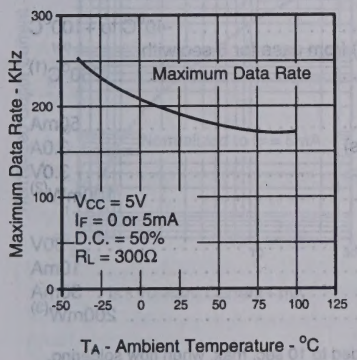
**Rise Time and Fall Time vs Ambient Temperature**



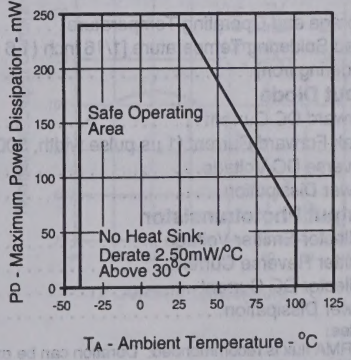

**Rise Time vs Output Load vs Ambient Temperature**




**Maximum Data Rate vs Ambient Temperature**

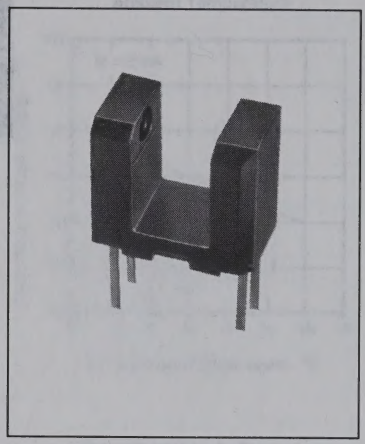


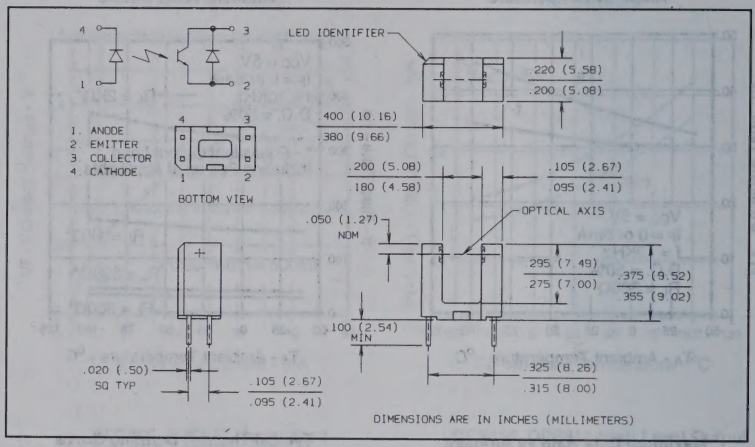

**Typical Thermal Derating Curve**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Slotted Optical Switch
## Type OPB620






### Features

- Non-contact switching
- Printed circuit board mounting
- 0.320" Lead centers
- 0.190" Gap
- Enhanced signal to noise ratio

### Description

The OPB620 slotted optical switch consists of an infrared emitting diode and an NPN silicon phototransistor with an enhanced low current roll-off to improve contrast ratio and immunity to background irradiance.

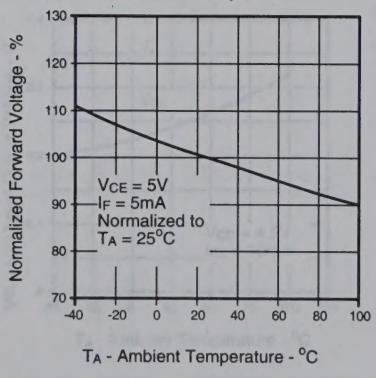
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec with soldering iron] | 260°C(1) |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 3.0V |
| Power Dissipation | 100mW(2) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter Reverse Current | 10mA |
| Collector DC Current | 30mA |
| Power Dissipation | 200mW(3) |

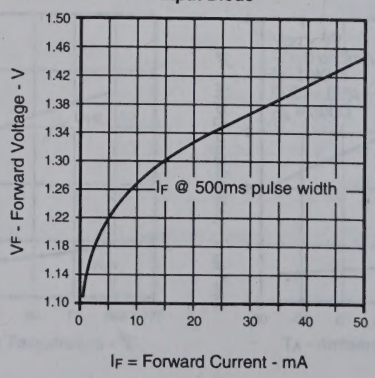
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.0 mW/°C above 25°C.

### Typical Performance Curves

**Normalized Forward Voltage vs Ambient Temperature**




**Forward Current vs Forward Voltage Input Diode**



# Types OPB620

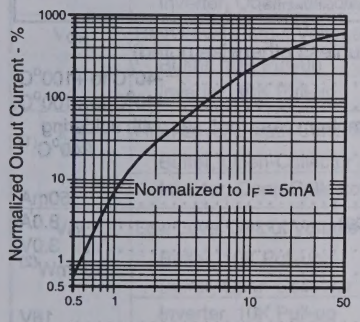
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.60 | V | $I_F$ = 10 mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 3.0 V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 100 µA |
| $I_{ECO}$ | Emitter Reverse Current | | 100 | µA | $V_{EC}$ = 0.4 V |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 5 V |
| **Coupled** | | | | | |
| $V_{SAT}$ | Saturation Voltage | | 0.40 | V | $I_F$ = 5 mA, $I_C$ = 100 µA |
| $I_{C(ON)}$ | On-State Collector Current | 1.0 | | mA | $I_F$ = 5 mA, $V_{CE}$ = 5 V |

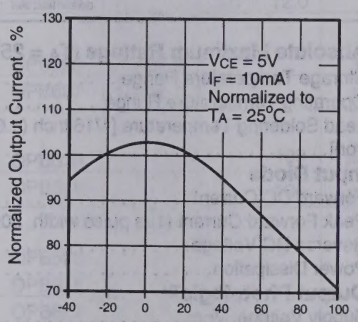


## Typical Performance Curves

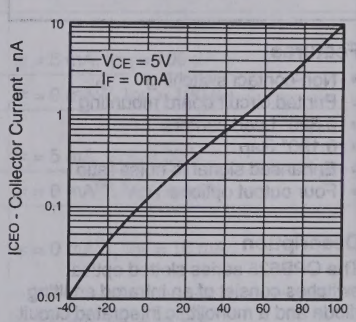
**Normalized Output Current vs Forward Current**



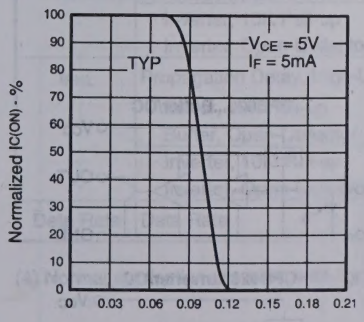

**Normalized Output Current vs Ambient Temperature**



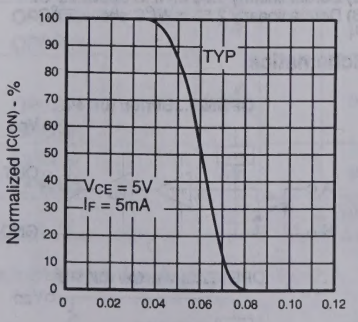

**Collector Dark Current vs Ambient Temperature**



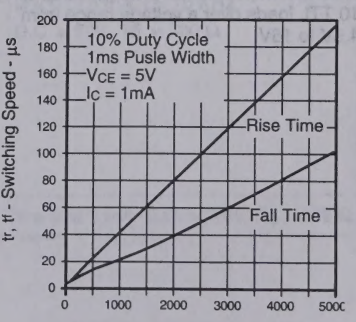

**Normalized $I_{C(ON)}$ vs Distance (X Axis Blocked)**




**Normalized $I_{C(ON)}$ vs Distance (Y Axis Blocked)**



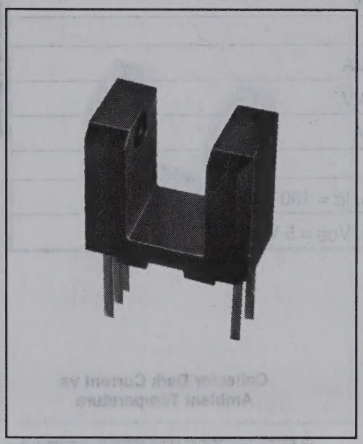

**Switching Speed vs Load**

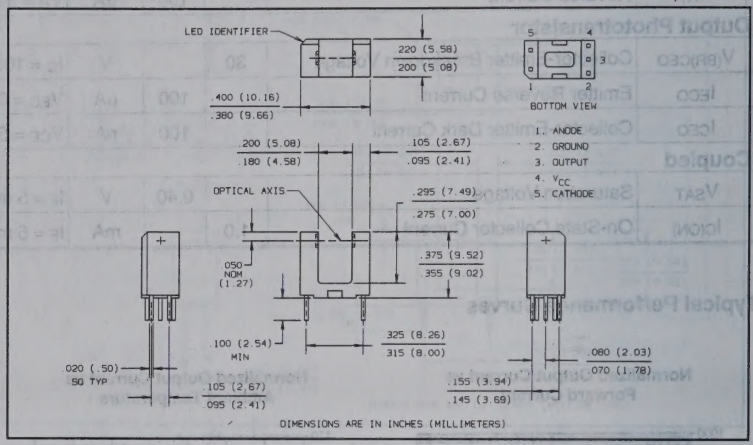



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Photologic™ Slotted Optical Switch
## Types OPB625, OPB626, OPB627, OPB628






### Features

- Non-contact switching
- Printed circuit board mounting
- 0.320" Lead centers
- 0.190" Gap
- Enhanced signal to noise ratio
- Four output options

### Description

The OPB625 series slotted optical switches consist of an infrared emitting diode and a monolithic integrated circuit which incorporates a photodiode, a linear amplifier and a Schmitt trigger on a single silicon chip.

The device features TTL/LSTTL compatible logic level output. Open collector output versions can drive up to 10 TTL loads over a voltage range from 4.5V to 16V.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature Range | -40°C to +100°C |
| Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec. with soldering iron] | 240°C(1) |

### Input Diode

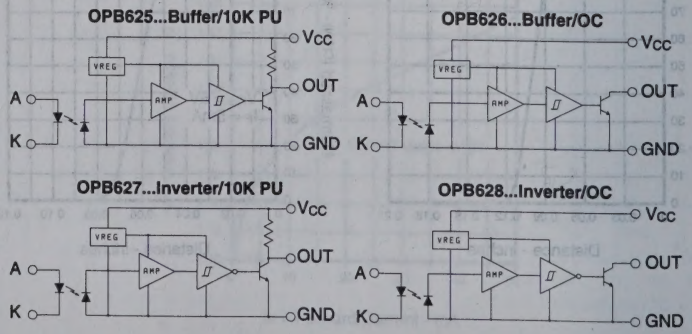
| | |
|---|---|
| Forward DC Current | 50mA |
| Peak Forward Current (1µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 3.0V |
| Power Dissipation | 100mW(2) |

### Output Photologic™

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 18V |
| Duration of Output Short To $V_{CC}$ | 1.00sec |
| Voltage at Output | 30V |
| Low Level Output Current (sinking) | 16mA |
| Power Dissipation | 240mW(3) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.50 mW/°C above 30°C.

### Schematics



# Types OPB625, OPB626, OPB627, OPB628

**Electrical Characteristics** ($T_A$ = 25°C, $V_{CC}$ = 4.5V to 16V unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | | | 1.6 | V | $I_F$ = 10 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 3.0 V |
| **Output Photologic™ Sensor** | | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | | 4.5 | | 16.0 | V | |
| $I_{F(+)}$ | LED Positive-Going Threshold Current | | 0.1 | 0.6 | 3.0 | mA | |
| $I_{F(+)}/I_{F(-)}$ | Hysteresis Ratio | | 1.05 | 1.20 | 1.60 | | |
| $I_{CCH}$ | High Level Supply Current: | | | | | | |
| | Buffer, 10K Pull-up | OPB625 | | 5.0 | 12.0 | mA | $I_F$ = 5 mA, No Load On Output |
| | Buffer, Open-Collector | OPB626 | | | | | |
| | Inverter, 10K Pull-up | OPB627 | | 4.0 | 12.0 | mA | $I_F$ = 0 mA(4), No Load On Output |
| | Inverter, Open-Collector | OPB628 | | | | | |
| $I_{CCL}$ | Low Level Supply Current: | | | | | | |
| | Buffer, 10K Pull-up | OPB625 | | 5.5 | 12.0 | mA | $I_F$ = 0 mA(4), No Load On Output |
| | Buffer, Open-Collector | OPB626 | | 4.0 | 12.0 | | |
| | Inverter, 10K Pull-up | OPB627 | | 6.5 | 12.0 | mA | $I_F$ = 5 mA, No Load On Output |
| | Inverter, Open-Collector | OPB628 | | 5.0 | 12.0 | | |
| $V_{OH}$ | High Level Output Voltage: | | | | | | |
| | Buffer, 10K Pull-up | OPB625 | ($V_{CC}$-1.5) | | | V | $I_F$ = 5 mA, $I_{OH}$ = 100 µA |
| | Inverter, 10K Pull-up | OPB627 | ($V_{CC}$-1.5) | | | V | $I_F$ = 0 mA(4), $I_{OH}$ = 100 µA |
| $I_{OH}$ | High Level Output Current: | | | | | | |
| | Buffer, Open-Collector | OPB626 | | | 100 | µA | $I_F$ = 5 mA, $V_{OH}$ = 30 V |
| | Inverter, Open-Collector | OPB628 | | | 100 | µA | $I_F$ = 0 mA(4), $V_{OH}$ = 30 V |
| $V_{OL}$ | Low Level Output Voltage: | | | | | | |
| | Buffer, 10K Pull-up | OPB625 | | | 0.4 | V | $I_F$ = 0 mA(4), $I_{OL}$ = 16 mA |
| | Buffer, Open-Collector | OPB626 | | | | | |
| | Inverter, 10K Pull-up | OPB627 | | | 0.4 | V | $I_F$ = 5 mA, $I_{OL}$ = 16 mA |
| | Inverter, Open-Collector | OPB628 | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | | 30 | | ns | $I_F$ = 0 or 5 mA, f = 10 KHz, D.C. = 50%, $R_L$ = 300 Ω |
| $t_{PLH}$ | Propagation Delay, Low-High | | | | | | |
| | Buffer, 10K Pull-up | OPB625 | | 0.6 | | µs | |
| | Buffer, Open-Collector | OPB626 | | | | | |
| | Inverter, 10K Pull-up | OPB627 | | 3.0 | | µs | |
| | Inverter, Open-Collector | OPB628 | | | | | |
| $t_{PHL}$ | Propagation Delay, High-Low | | | | | | |
| | Buffer, 10K Pull-up | OPB625 | | 3.0 | | µs | |
| | Buffer, Open-Collector | OPB626 | | | | | |
| | Inverter, 10K Pull-up | OPB627 | | 0.6 | | µs | |
| | Inverter, Open-Collector | OPB628 | | | | | |
| Data Rate | Data Rate | | | 100 | | KHz | $I_F$ = 0 or 5 mA, D.C. = 50%, $R_L$ = 300 Ω |

(4) Normal application would be with light source blocked, simulated by $I_F$ = 0mA.

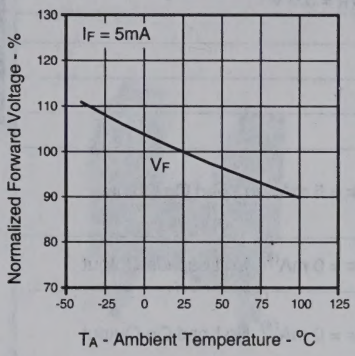


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

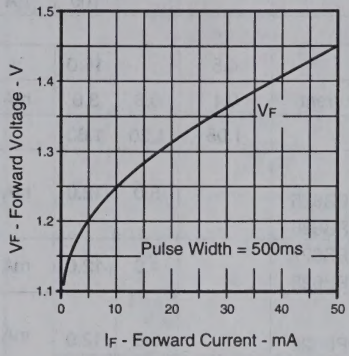
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

## Typical Performance Curves

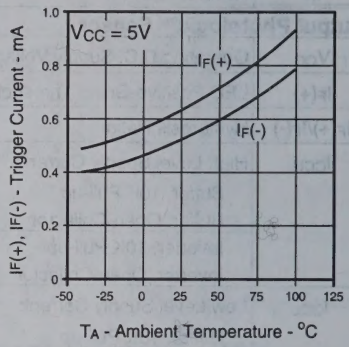
**Normalized Forward Voltage vs Ambient Temperature**



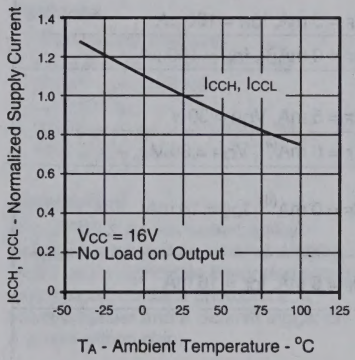

**Forward Voltage vs Forward Current Input Diode**



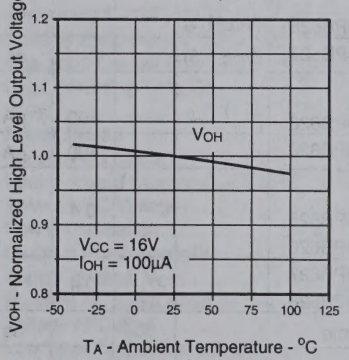

**Trigger Current vs Ambient Temperature**



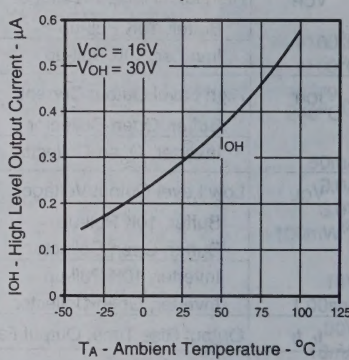

**Normalized Supply Current vs Ambient Temperature**



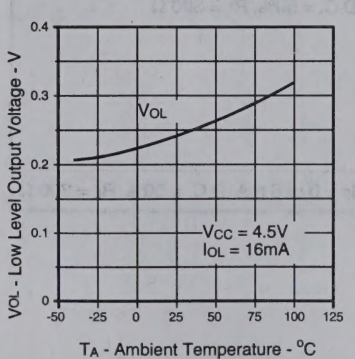

**OPB625, OPB627 Normalized High Level Output Voltage vs Ambient Temperature**



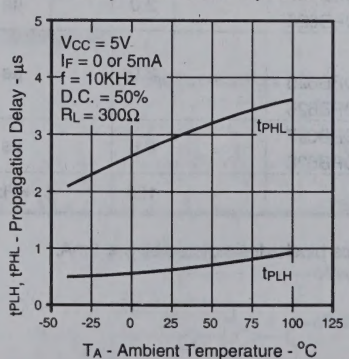

**OPB626, OPB628 High Level Output Current vs Ambient Temperature**



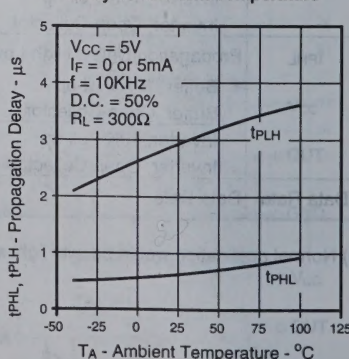

**Low Level Output Voltage vs Ambient Temperature**




**OPB625, OPB626 Propagation Delay vs Ambient Temperature**

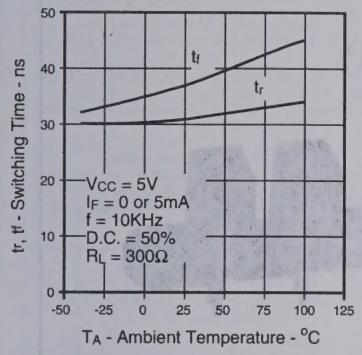



**OPB627, OPB628 Propagation Delay vs Ambient Temperature**

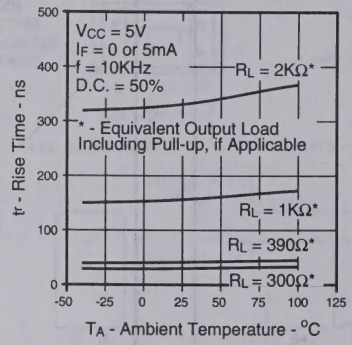


## Typical Performance Curves

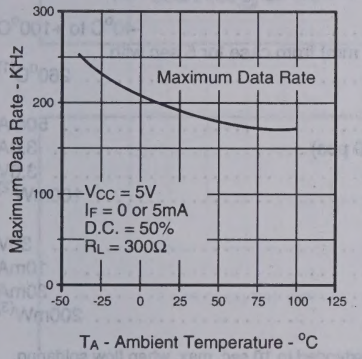
**Rise Time and Fall Time vs Ambient Temperature**



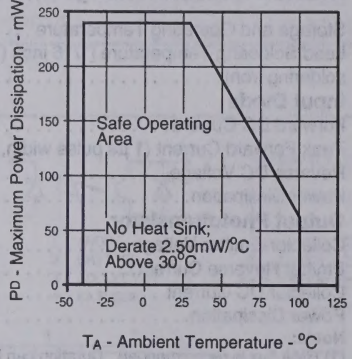

**Rise Time vs Output Load vs Ambient Temperature**




**Maximum Data Rate vs Ambient Temperature**

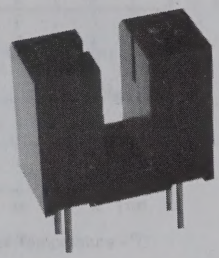



**Typical Thermal Derating Curve**

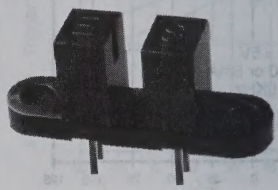



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Slotted Optical Switch
## Types OPB660N, OPB660T



Package N



Package T

### Features

- Non-contact switching
- 0.125" Wide gap
- 0.320" Lead spacing
- N or T package
- Printed circuit board mounting
- Enhanced signal to noise ratio

### Description

The OPB660 series consists of an NPN phototransistor and an infrared emitting diode mounted on opposite sides of a 0.125" wide slot. The emitter has a 0.050" x 0.060" molded aperture while the phototransistor has a 0.010" x 0.060" molded aperture. The phototransistor has an enhanced low current roll-off which improves contrast ratio and immunity to background irradiance.

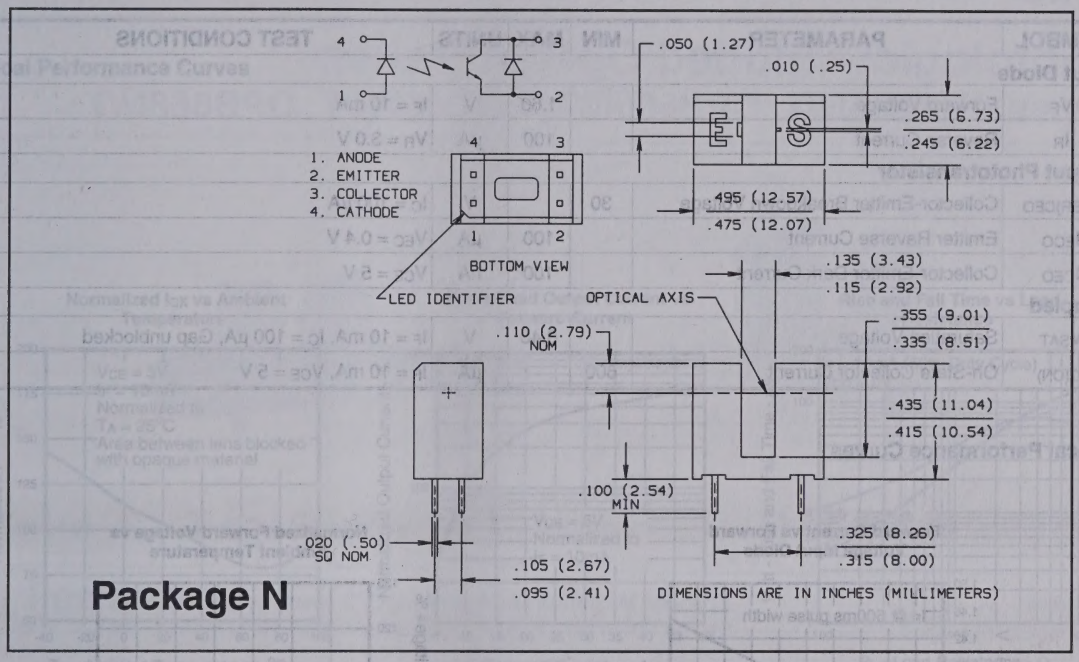
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec with soldering iron] | 260°C(1) |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 3.0V |
| Power Dissipation | 100mW(2) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter Reverse Current | 10mA |
| Collector DC Current | 30mA |
| Power Dissipation | 200mW(3) |

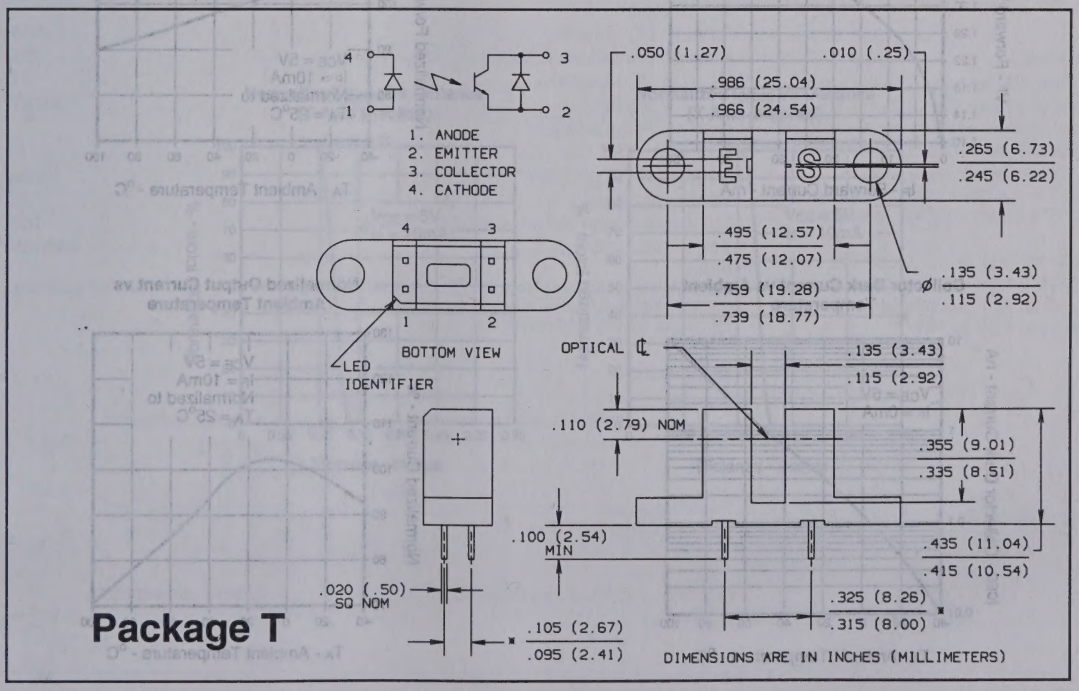
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.0 mW/°C above 25°C.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB660N, OPB660T




## Package N




## Package T

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Types OPB660N, OPB660T

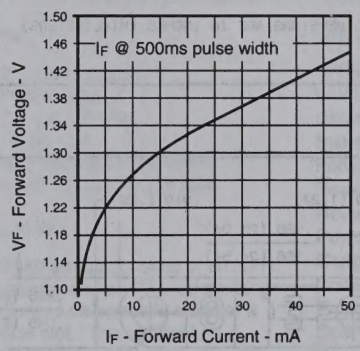
OPTEK

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

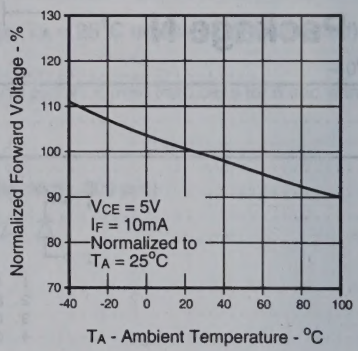
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.60 | V | $I_F$ = 10 mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 3.0 V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 100 µA |
| $I_{ECO}$ | Emitter Reverse Current | | 100 | µA | $V_{EC}$ = 0.4 V |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 5 V |
| **Coupled** | | | | | |
| $V_{SAT}$ | Saturation Voltage | | 0.40 | V | $I_F$ = 10 mA, $I_C$ = 100 µA, Gap unblocked |
| $I_{C(ON)}$ | On-State Collector Current | 600 | | µA | $I_F$ = 10 mA, $V_{CE}$ = 5 V |

## Typical Performance Curves

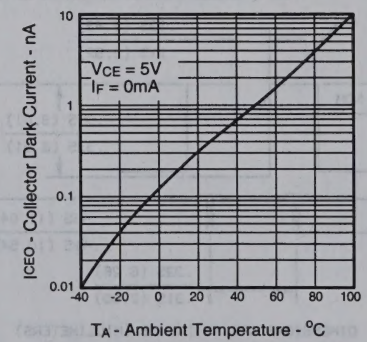
**Forward Current vs Forward Voltage Input Diode**



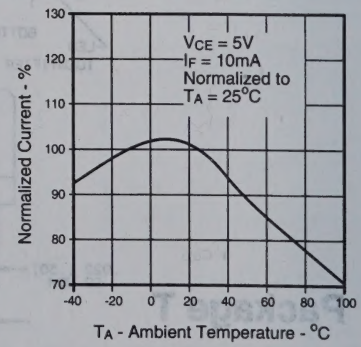

**Normalized Forward Voltage vs Ambient Temperature**




**Collector Dark Current vs Ambient Temperature**

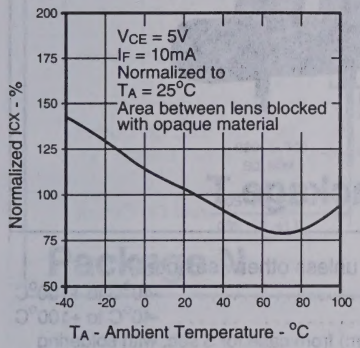



**Normalized Output Current vs Ambient Temperature**

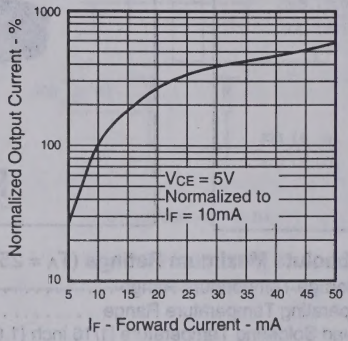


## Typical Performance Curves

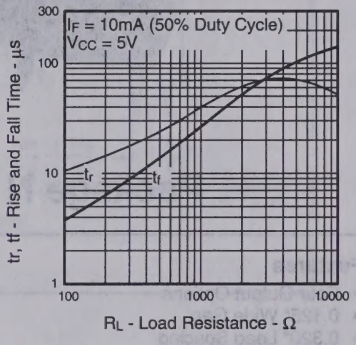
**Normalized $I_{CX}$ vs Ambient Temperature**



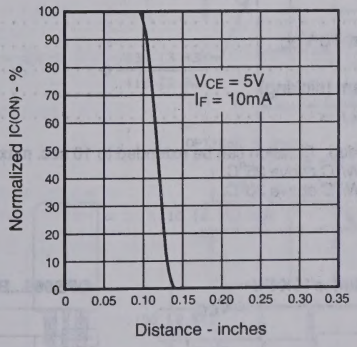

**Normalized Output Current vs Forward Current**



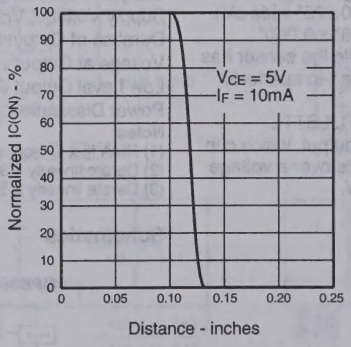

**Rise and Fall Time vs Load Resistance**




**Normalized $I_{C(ON)}$ vs Distance (Y Axis Blocked)**

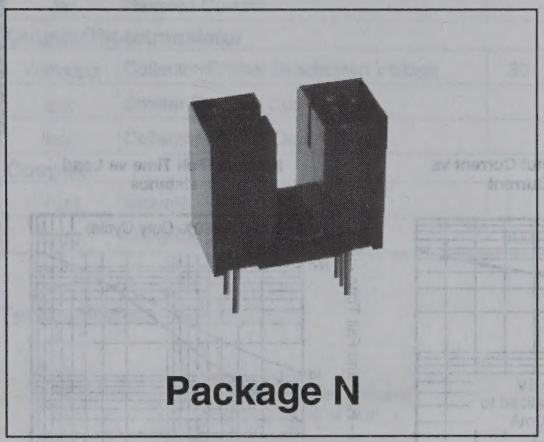



**Normalized $I_{C(ON)}$ vs Distance (X Axis Blocked)**

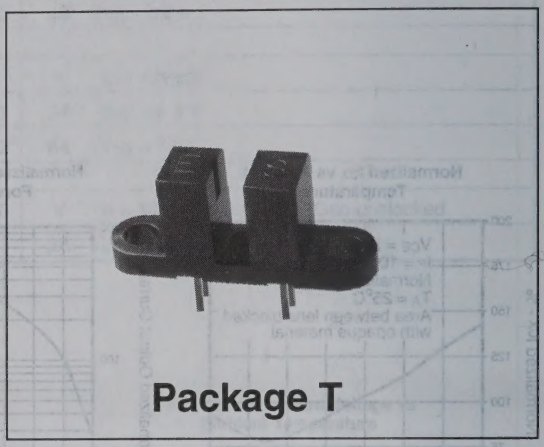



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Photologic™ Slotted Optical Switch
## Types OPB665N/T, OPB666N/T, OPB667N/T, OPB668N/T



Package N



Package T

### Features
- Four Output Options
- 0.125" Wide Gap
- 0.320" Lead Spacing
- N or T Package
- 0.010" Sensor Aperture

### Description
The OPB665 series optical switches consist of a monolithic integrated circuit and an infrared emitting diode mounted on opposite sides of a 0.125" wide slot. The emitter has a 0.050" x 0.060" molded-in aperture while the sensor has a 0.010" x 0.060" molded-in aperture.

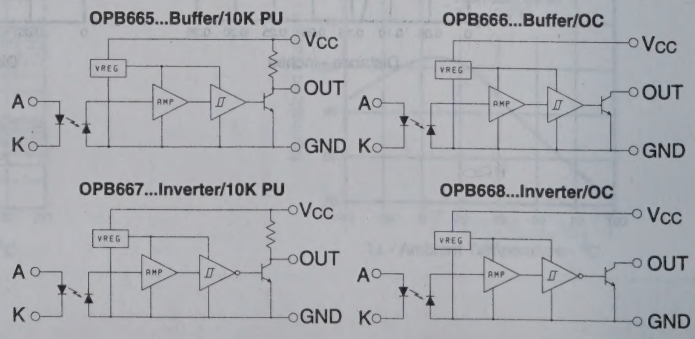
The device features TTL/LSTTL compatible logic level output, which can drive up to 10 TTL loads over a voltage range from 4.5V to 16V.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature Range | -40°C to +100°C |
| Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec. with soldering iron] | 240°C(1) |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 3.0V |
| Power Dissipation | 100mW(2) |
| **Output Photologic™** | |
| Supply Voltage, $V_{CC}$ | 18V |
| Duration of Output Short To $V_{CC}$ | 1.00sec |
| Voltage at Output | 30V |
| Low Level Output Current (sinking) | 16mA |
| Power Dissipation | 240mW(3) |

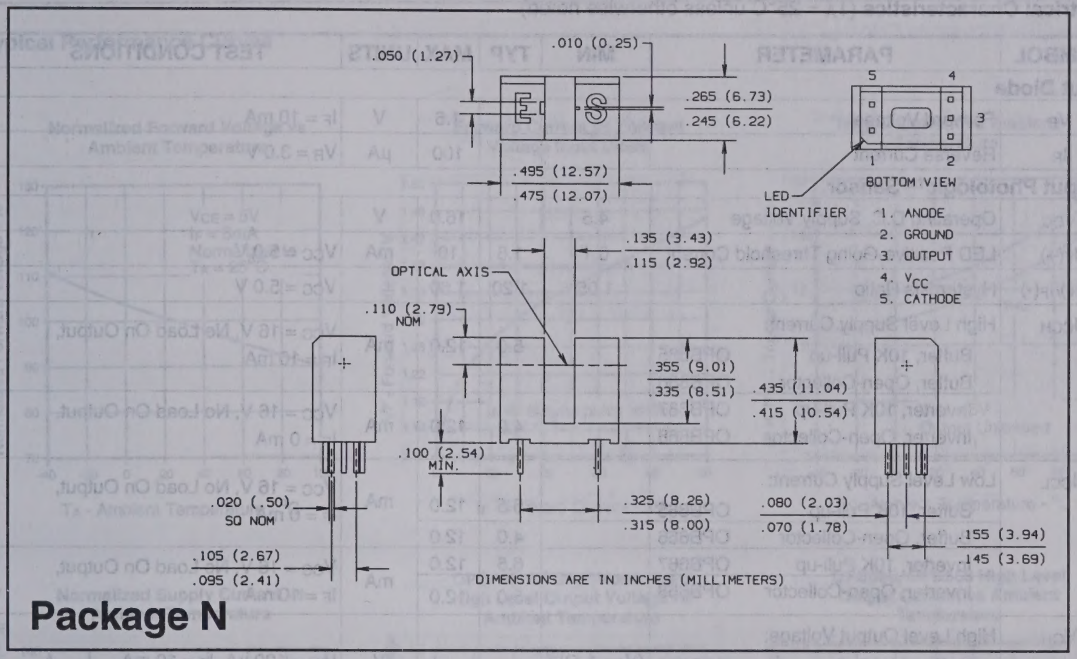
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.50 mW/°C above 30°C.

### Schematics

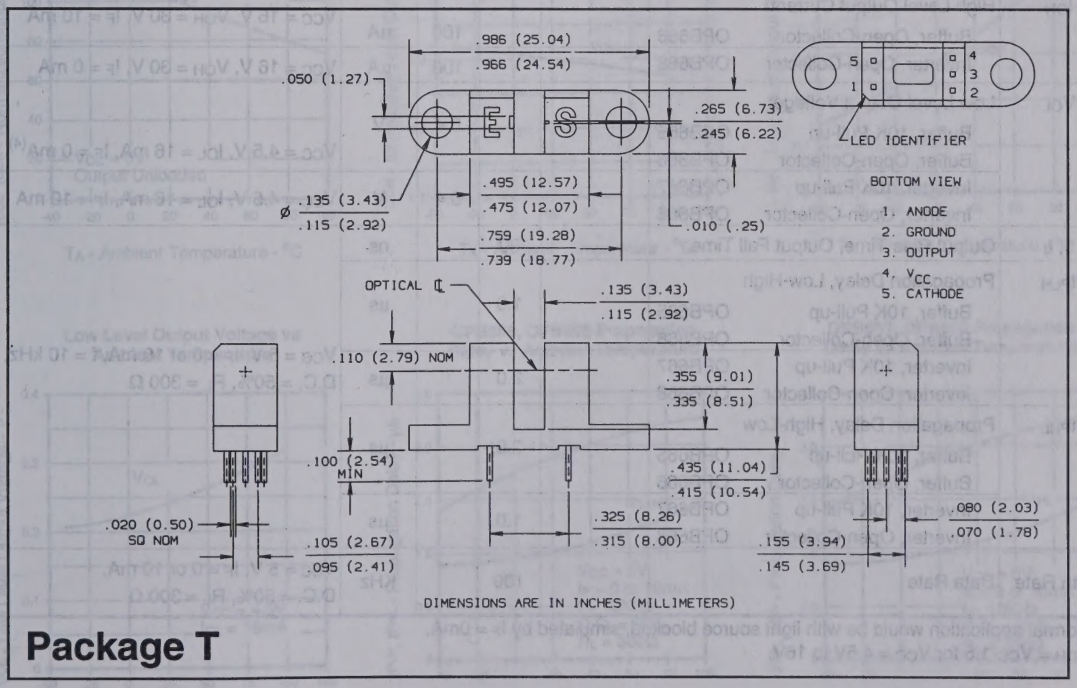


# Types OPB665N/T, OPB666N/T, OPB667N/T, OPB668N/T






## Package N




## Package T

# Types OPB665N/T, OPB666N/T, OPB667N/T, OPB668N/T

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | | | 1.6 | V | $I_F$ = 10 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 3.0 V |
| **Output Photologic™ Sensor** | | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | | 4.5 | | 16.0 | V | |
| $I_F(+)$ | LED Positive-Going Threshold Current | | 0.1 | 1.6 | 10 | mA | $V_{CC}$ = 5.0 V |
| $I_F(+)/I_F(-)$ | Hysteresis Ratio | | 1.05 | 1.20 | 1.60 | | $V_{CC}$ = 5.0 V |
| $I_{CCH}$ | High Level Supply Current: | | | | | | |
| | Buffer, 10K Pull-up | OPB665 | | 5.0 | 12.0 | mA | $V_{CC}$ = 16 V, No Load On Output, $I_F$ = 10 mA |
| | Buffer, Open-Collector | OPB666 | | | | | |
| | Inverter, 10K Pull-up | OPB667 | | 4.0 | 12.0 | mA | $V_{CC}$ = 16 V, No Load On Output, $I_F$ = 0 mA |
| | Inverter, Open-Collector | OPB668 | | | | | |
| $I_{CCL}$ | Low Level Supply Current: | | | | | | |
| | Buffer, 10K Pull-up | OPB665 | | 5.5 | 12.0 | mA | $V_{CC}$ = 16 V, No Load On Output, $I_F$ = 0 mA |
| | Buffer, Open-Collector | OPB666 | | 4.0 | 12.0 | | |
| | Inverter, 10K Pull-up | OPB667 | | 6.5 | 12.0 | mA | $V_{CC}$ = 16 V, No Load On Output, $I_F$ = 10 mA |
| | Inverter, Open-Collector | OPB668 | | 5.0 | 12.0 | | |
| $V_{OH}$ | High Level Output Voltage: | | | | | | |
| | Buffer, 10K Pull-up | OPB665 | ($V_{CC}$-1.5)[5] | | | V | $I_{OH}$ = 100 µA, $I_F$ = 10 mA |
| | Inverter, 10K Pull-up | OPB667 | ($V_{CC}$-1.5)[5] | | | V | $I_{OH}$ = 100 µA, $I_F$ = 0 mA[4] |
| $I_{OH}$ | High Level Output Current: | | | | | | |
| | Buffer, Open-Collector | OPB666 | | | 100 | µA | $V_{CC}$ = 16 V, $V_{OH}$ = 30 V, $I_F$ = 10 mA |
| | Inverter, Open-Collector | OPB668 | | | 100 | µA | $V_{CC}$ = 16 V, $V_{OH}$ = 30 V, $I_F$ = 0 mA |
| $V_{OL}$ | Low Level Output Voltage: | | | | | | |
| | Buffer, 10K Pull-up | OPB665 | | | 0.4 | V | $V_{CC}$ = 4.5 V, $I_{OL}$ = 16 mA, $I_F$ = 0 mA[4] |
| | Buffer, Open-Collector | OPB666 | | | | | |
| | Inverter, 10K Pull-up | OPB667 | | | 0.4 | V | $V_{CC}$ = 4.5 V, $I_{OL}$ = 16 mA, $I_F$ = 10 mA |
| | Inverter, Open-Collector | OPB668 | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | | 30 | | ns | $V_{CC}$ = 5 V, $I_F$ = 0 or 10 mA, f = 10 kHz, D.C. = 50%, $R_L$ = 300 Ω |
| $t_{PLH}$ | Propagation Delay, Low-High | | | | | | |
| | Buffer, 10K Pull-up | OPB665 | | 1.0 | | µs | |
| | Buffer, Open-Collector | OPB666 | | | | | |
| | Inverter, 10K Pull-up | OPB667 | | 2.0 | | µs | |
| | Inverter, Open-Collector | OPB668 | | | | | |
| $t_{PHL}$ | Propagation Delay, High-Low | | | | | | |
| | Buffer, 10K Pull-up | OPB665 | | 2.0 | | µs | |
| | Buffer, Open-Collector | OPB666 | | | | | |
| | Inverter, 10K Pull-up | OPB667 | | 1.0 | | µs | |
| | Inverter, Open-Collector | OPB668 | | | | | |
| Data Rate | Data Rate | | | 100 | | KHz | $V_{CC}$ = 5 V, $I_F$ = 0 or 10 mA, D.C. = 50%, $R_L$ = 300 Ω |

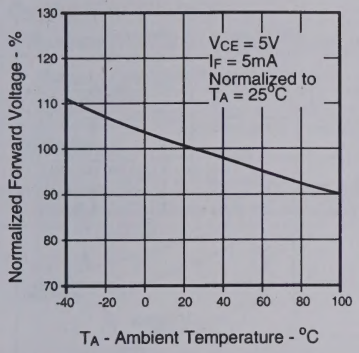
(4) Normal application would be with light source blocked, simulated by $I_F$ = 0mA.
(5) $V_{OH}$ = $V_{CC}$-1.5 for $V_{CC}$ = 4.5V to 16V.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

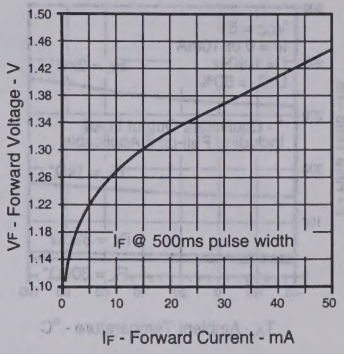
# Types OPB665N/T, OPB666N/T, OPB667N/T, OPB668N/T

## Typical Performance Curves

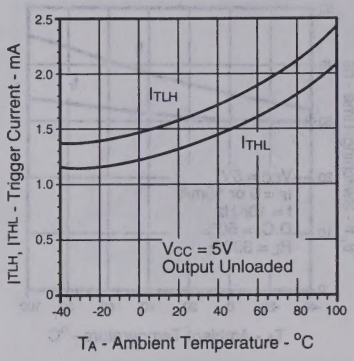
**Normalized Forward Voltage vs Ambient Temperature**



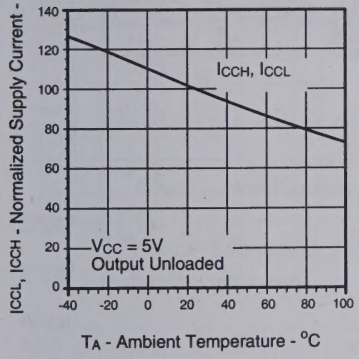

**Forward Current vs Forward Voltage Input Diode**



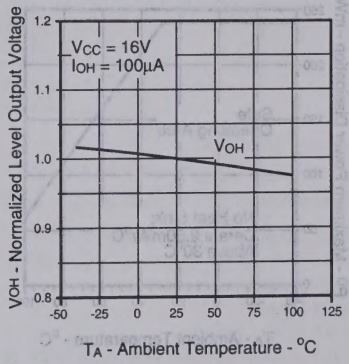

**Trigger Current vs Ambient Temperature**



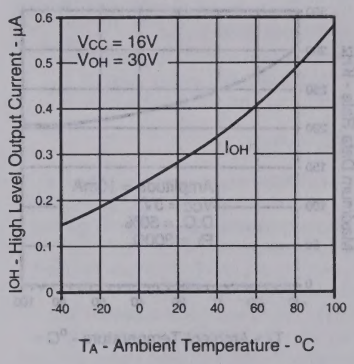

**Normalized Supply Current vs Ambient Temperature**



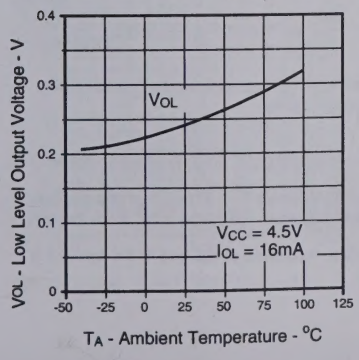

**OPB665, OPB667 Normalized High Level Output Voltage vs Ambient Temperature**



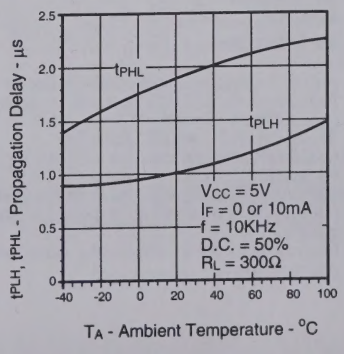

**OPB666, OPB668 High Level Output Current vs Ambient Temperature**



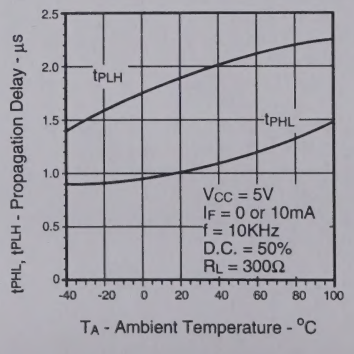

**Low Level Output Voltage vs Ambient Temperature**




**OPB665, OPB666 Propagation Delay vs Ambient Temperature**



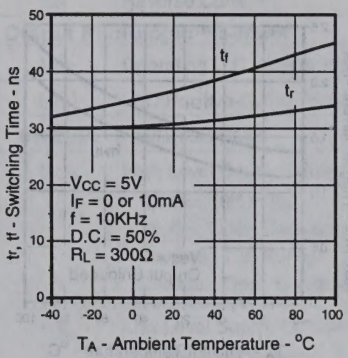

**OPB667, OPB668 Propagation Delay vs Ambient Temperature**



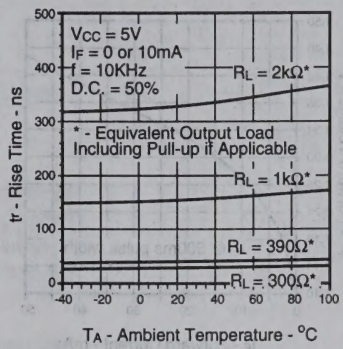

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

## Typical Performance Curves

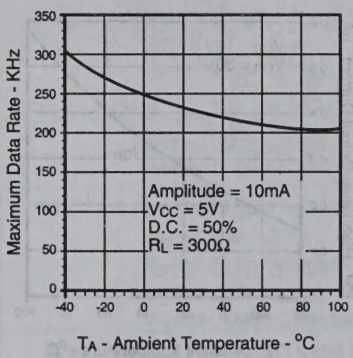
**Switching Time vs Ambient Temperature**



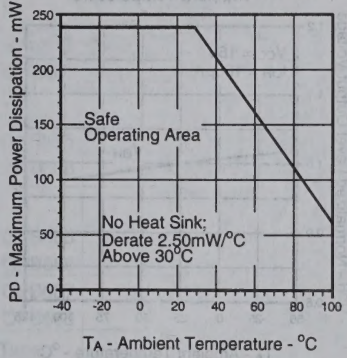

**Rise Time vs Output Load vs Ambient Temperature**

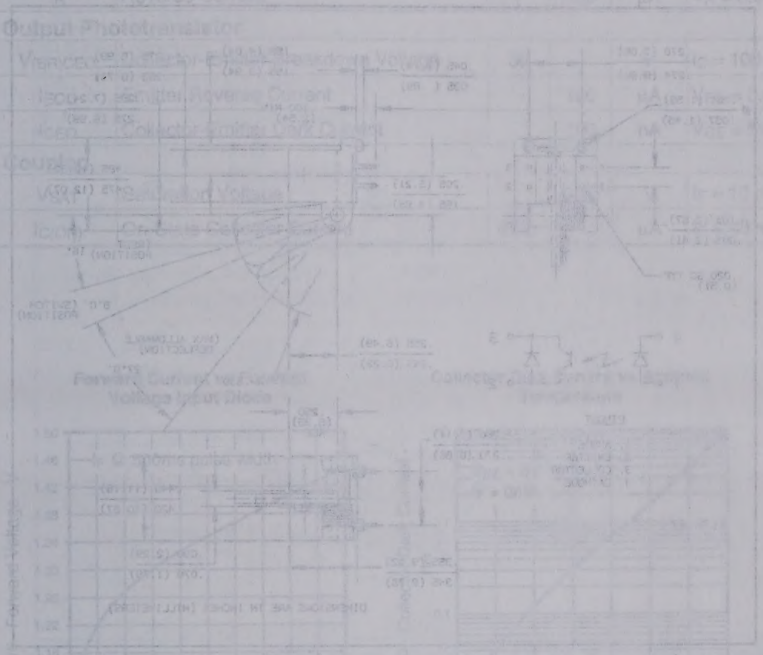

Vcc = 5V
IF = 0 or 10mA
f = 10KHz
D.C. = 50%
RL = 2kΩ*
* - Equivalent Output Load Including Pull-up if Applicable
RL = 1kΩ*
RL = 390Ω*
RL = 300Ω*
tr - Rise Time - ns
TA - Ambient Temperature - °C

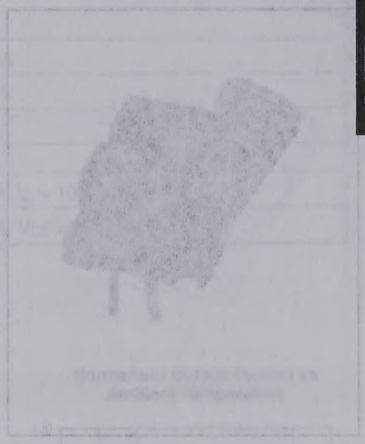
**Maximum Data Rate vs Ambient Temperature**



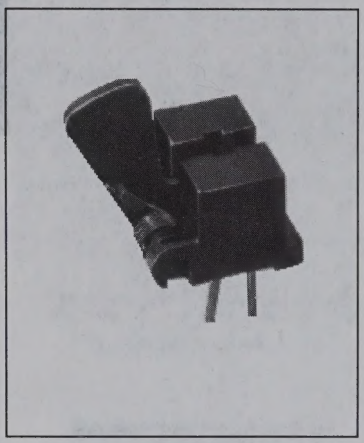

**Typical Thermal Derating Curve**

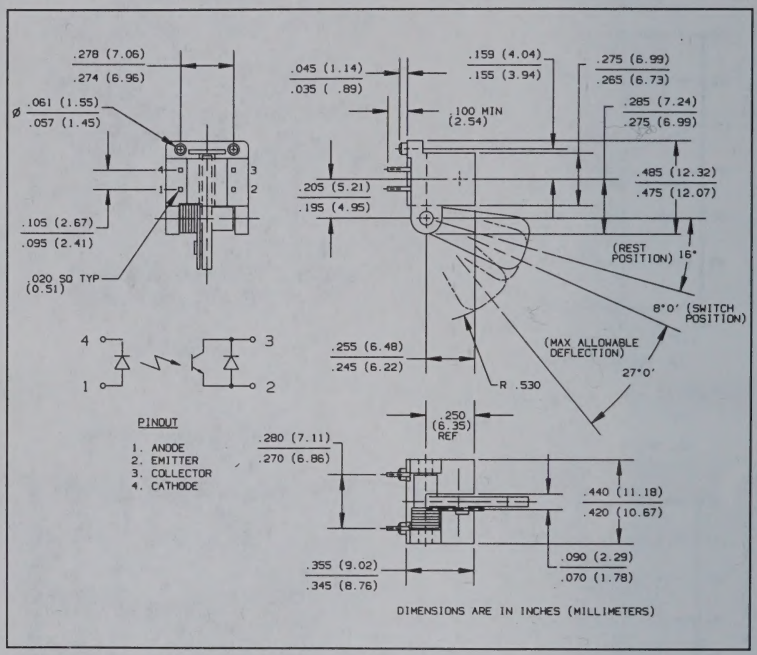






# Slotted Optical Flag Switch
## Type OPB680






### Features

- Phototransistor output
- Mechanical switch replacement
- Printed circuit board mounting
- Enhanced signal to noise ratio

### Description

The OPB680 consists of an NPN phototransistor and an infrared emitting diode in a molded plastic housing. The phototransistor has an enhanced low current roll-off which improves contrast ratio and immunity to background irradiance. A lever arm actuated flag interrupts the light beam, switching the transistor output between states that can readily drive logic gates.

Customized lever arms and spring torques can be designed for specific applications.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec with soldering iron] | 260°C |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 3.0V |
| Power Dissipation | 100mW(2) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter Reverse Current | 10mA |
| Collector DC Current | 30mA |
| Power Dissipation | 200mW(3) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.0 mW/°C above 25°C.
(4) "On" condition exists when the lever arm is in the rest position (16° from vertical) as shown in the figure.
(5) "Off" condition exists when the lever arm is deflected clockwise 8° ± 3° from the rest position (16° from vertical) as shown in the figure. Maximum allowable deflection is 35° from the rest position.
(6) From the rest position to the switch point, lever torque measured at the end of the arm is 1.5 grams max.

# Type OPB680

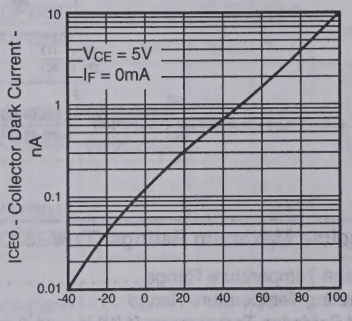
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.60 | V | $I_F$ = 10 mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 3.0 V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 100 µA |
| $I_{ECO}$ | Emitter Reverse Current | | 100 | µA | $V_{EC}$ = 0.4 V |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 5V |
| **Coupled** | | | | | |
| $V_{SAT}$ | Saturation Voltage | | 0.40 | V | $I_F$ = 10 mA, $I_C$ = 100 µA, Gap unblocked |
| $I_{C(ON)}$ | On-State Collector Current | 600 | | µA | $I_F$ = 10 mA, $V_{CE}$ = 5 V |

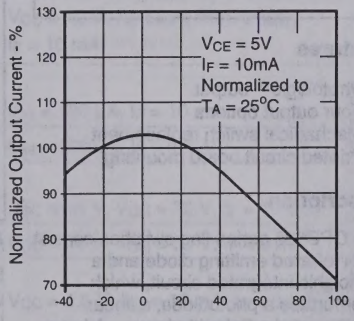


**Forward Current vs Forward Voltage Input Diode**

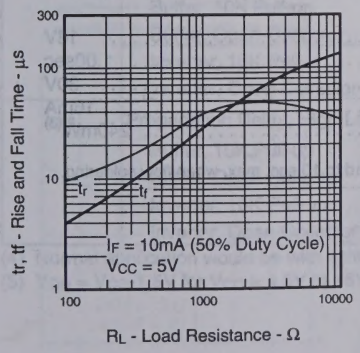
**Collector Dark Current vs Ambient Temperature**



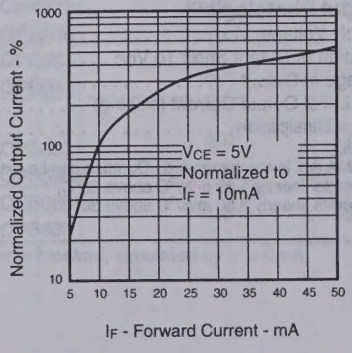

**Normalized Output Current vs Ambient Temperature**



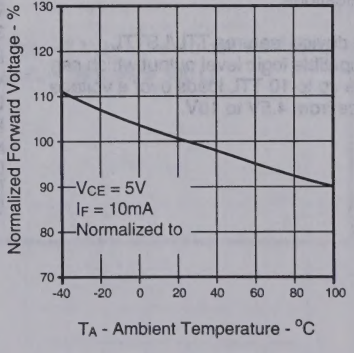

**Rise and Fall Time vs Load Resistance**




**Normalized Output Current vs Forward Current**



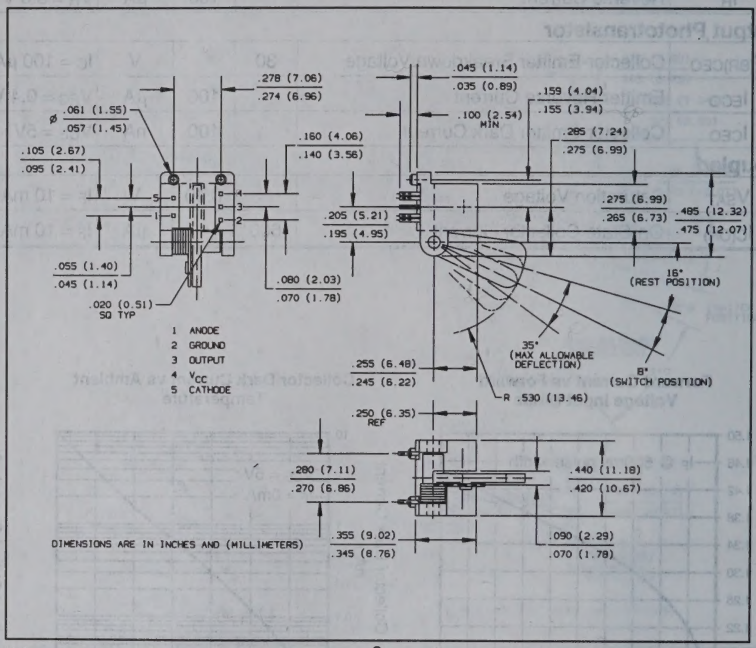

**Normalized Forward Voltage vs Ambient Temperature**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Photologic™ Optical Flag Switch
## Types OPB685, OPB686, OPB687, OPB688




### Features

- Photologic™ output
- Four output options
- Mechanical switch replacement
- Printed circuit board mounting

### Description

The OPB685 series flag switches consist of an infrared emitting diode and a monolithic integrated circuit, which incorporates a photodiode, a linear amplifier and a Schmitt trigger. A lever arm actuated flag interrupts the light beam switching the output between states that can readily drive logic gates.

Customized lever arms and spring torques can be designed for specific applications.

The device features TTL/LSTTL compatible logic level output which can drive up to 10 TTL loads over a voltage range from 4.5V to 16V.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature Range | -40°C to +100°C |
| Operating Temperature Range | -40°C to +100°C |
| Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec. with soldering iron] | 240°C |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 3.0V |
| Power Dissipation | 100mW(2) |
| **Output Photologic™** | |
| Supply Voltage, $V_{CC}$ | 18V |
| Duration of Output Short To $V_{CC}$ | 1.00sec |
| Voltage at Output | 30V |
| Low Level Output Current (sinking) | 16mA |
| Power Dissipation | 240mW(3) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.50 mW/°C above 30°C.

# Types OPB685, OPB686, OPB687, OPB688

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | | | 1.6 | V | $I_F$ = 10 mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 3.0 V |
| **Output Photologic™ Sensor** | | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | | 4.5 | | 16.0 | V | |
| $I_{F(+)}$ | LED Positive-Going Threshold Current | | 0.1 | 1.8 | 10.0 | mA | $V_{CC}$ = 5.0 V |
| $I_{F(+)}/I_{F(-)}$ | Hysteresis Ratio | | 1.05 | 1.20 | 1.60 | | $V_{CC}$ = 5.0 V |
| $I_{CCH}$ | High Level Supply Current: | | | | | | |
| | Buffer, 10K Pull-up | OPB685 | | 5.0 | 12.0 | mA | $V_{CC}$ = 16 V, No Load On Output, $I_F$ = 10 mA |
| | Buffer, Open-Collector | OPB686 | | | | | |
| | Inverter, 10K Pull-up | OPB687 | | 4.0 | 12.0 | mA | $V_{CC}$ = 16 V, No Load On Output, $I_F$ = 0 mA |
| | Inverter, Open-Collector | OPB688 | | | | | |
| $I_{CCL}$ | Low Level Supply Current: | | | | | | |
| | Buffer, 10K Pull-up | OPB685 | | 5.5 | 12.0 | mA | $V_{CC}$ = 16 V, No Load On Output, $I_F$ = 0 mA |
| | Buffer, Open-Collector | OPB686 | | 4.0 | 12.0 | | |
| | Inverter, 10K Pull-up | OPB687 | | 6.5 | 12.0 | mA | $V_{CC}$ = 16 V, No Load On Output, $I_F$ = 10 mA |
| | Inverter, Open-Collector | OPB688 | | 5.0 | 12.0 | | |
| $V_{OH}$ | High Level Output Voltage: | | | | | | |
| | Buffer, 10K Pull-up | OPB685 | ($V_{CC}$-1.5)(5) | | | V | $I_{OH}$ = 100 µA, $I_F$ = 10 mA |
| | Inverter, 10K Pull-up | OPB687 | ($V_{CC}$-1.5)(5) | | | V | $I_{OH}$ = 100 µA, $I_F$ = 0 mA(4) |
| $I_{OH}$ | High Level Output Current: | | | | | | |
| | Buffer, Open-Collector | OPB686 | | | 100 | µA | $V_{CC}$ = 16 V, $V_{OH}$ = 30 V, $I_F$ = 10 mA |
| | Inverter, Open-Collector | OPB688 | | | 100 | µA | $V_{CC}$ = 16 V, $V_{OH}$ = 30 V, $I_F$ = 0 mA |
| $V_{OL}$ | Low Level Output Voltage: | | | | | | |
| | Buffer, 10K Pull-up | OPB685 | | | 0.4 | V | $V_{CC}$ = 4.5 V, $I_{OL}$ = 16 mA, $I_F$ = 0 mA(4) |
| | Buffer, Open-Collector | OPB686 | | | | | |
| | Inverter, 10K Pull-up | OPB687 | | | 0.4 | V | $V_{CC}$ = 4.5 V, $I_{OL}$ = 16 mA, $I_F$ = 10 mA |
| | Inverter, Open-Collector | OPB688 | | | | | |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | | 30 | | ns | $V_{CC}$ = 5 V, $I_F$ = 0 or 10 mA, f = 10 kHz, D.C. = 50%, $R_L$ = 300 Ω |
| $t_{PLH}$ | Propagation Delay, Low-High | | | | | | |
| | Buffer, 10K Pull-up | OPB685 | | 1.0 | | µs | |
| | Buffer, Open-Collector | OPB686 | | | | | |
| | Inverter, 10K Pull-up | OPB687 | | 2.0 | | µs | |
| | Inverter, Open-Collector | OPB688 | | | | | |
| $t_{PHL}$ | Propagation Delay, High-Low | | | | | | |
| | Buffer, 10K Pull-up | OPB685 | | 2.0 | | µs | |
| | Buffer, Open-Collector | OPB686 | | | | | |
| | Inverter, 10K Pull-up | OPB687 | | 1.0 | | µs | |
| | Inverter, Open-Collector | OPB688 | | | | | |

(4) Normal application would be with light source blocked, simulated by $I_F$ = 0mA.
(5) $V_{OH}$ = $V_{CC}$-1.5V for $V_{CC}$ = 4.5V to 16V.

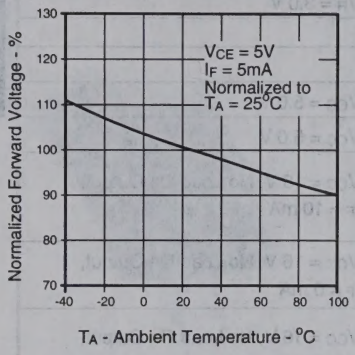


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

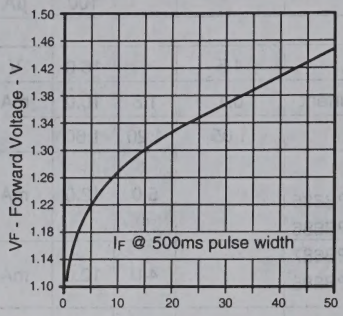
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

## Typical Performance Curves

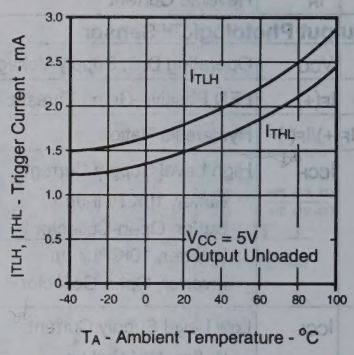
**Normalized Forward Voltage vs Ambient Temperature**



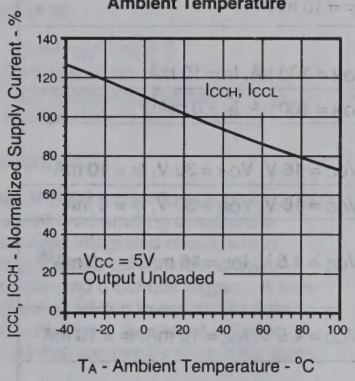

**Forward Current vs Forward Voltage Input Diode**



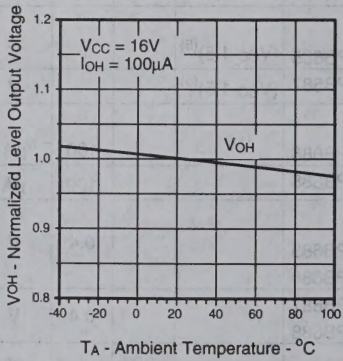

**Trigger Current vs Ambient Temperature**



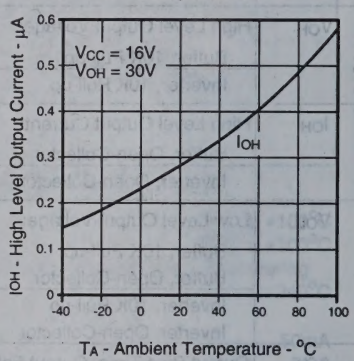

**Normalized Supply Current vs Ambient Temperature**



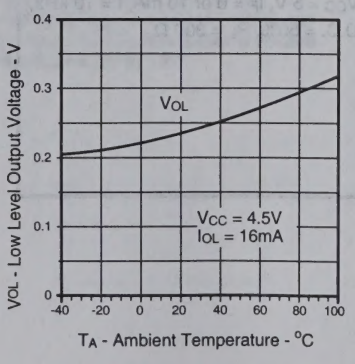

**OPB685, OPB687 Normalized High Level Output Voltage vs Ambient Temperature**



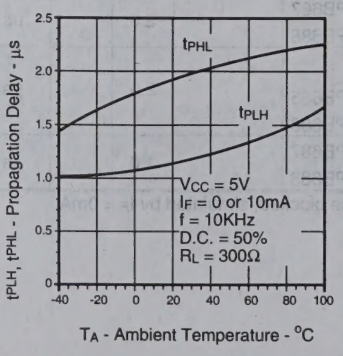

**OPB686, OPB688 High Level Output Current vs Ambient Temperature**



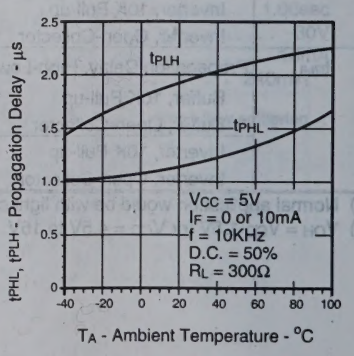

**Low Level Output Voltage vs Ambient Temperature**




**OPB685, OPB686 Propagation Delay vs Ambient Temperature**

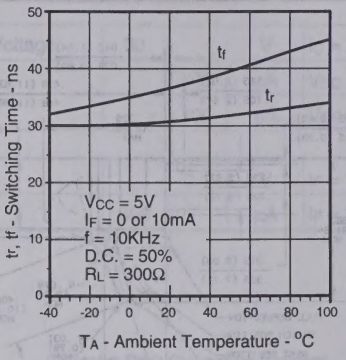



**OPB687, OPB688 Propagation Delay vs Ambient Temperature**

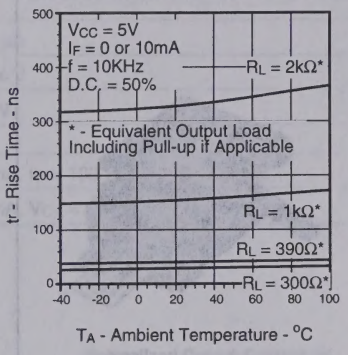


## Typical Performance Curves

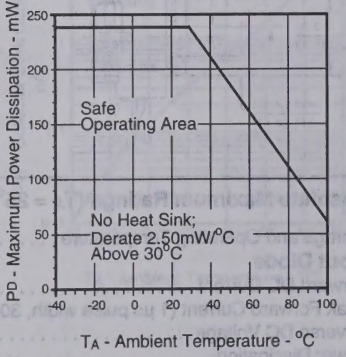
**Switching Time vs Ambient Temperature**



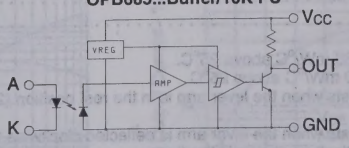

**Rise Time vs Output Load vs Ambient Temperature**



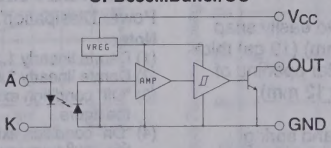

**Typical Thermal Derating Curve**



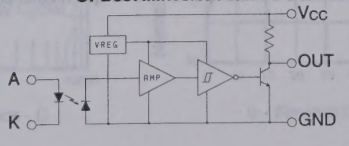

**OPB685...Buffer/10K PU**



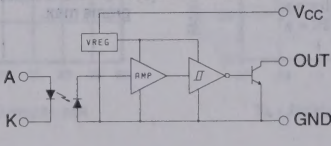

**OPB686...Buffer/OC**




**OPB687...Inverter/10K PU**

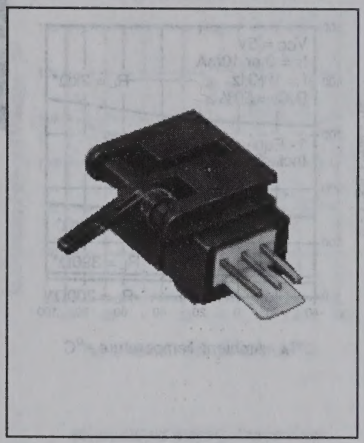


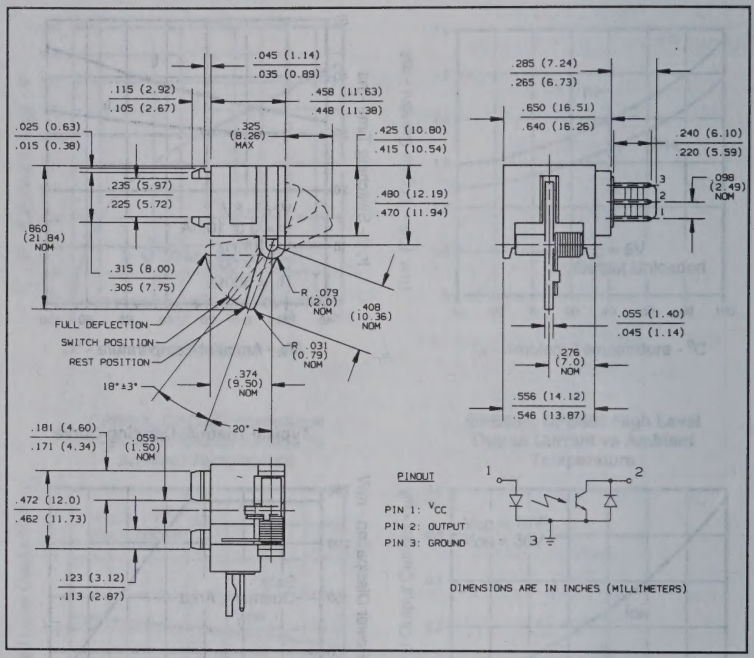

**OPB688...Inverter/OC**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Slotted Optical Flag Switch
## Type OPB690






### Features

- Phototransistor output
- Mechanical switch replacement
- 3-pin connector (Ho Tien L2561-03), Molex compatible connector 5102 series housing and 5103 series terminal
- Enhanced signal to noise ratio

### Description

The OPB690 consists of an NPN phototransistor and an infrared emitting diode in a molded plastic housing. The phototransistor has an enhanced low current roll-off which improves contrast ratio and immunity to background irradiance. A lever arm actuated flag interrupts the light beam, switching the transistor output between states that can readily drive logic gates.

This switch is designed to easily snap mount into a 0.039" (1 mm) (19 ga) thick material with a rectangular opening of 0.315" x 0.472" (8 mm x 12 mm).

Customized lever arms and spring torques can be designed for specific applications.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -40°C to +100°C |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 3.0V |
| Power Dissipation | 100mW(1) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter Reverse Current | 10mA |
| Collector DC Current | 30mA |
| Power Dissipation | 200mW(2) |

**Notes:**
(1) Derate linearly 1.33 mW/°C above 25°C.
(2) Derate linearly 2.0 mW/°C above 25°C.
(3) "Off" condition exists when the lever arm is in the rest position (20° from vertical) as shown in the figure.
(4) "On" condition exists when the lever arm is deflected clockwise 18° +/- 3° form the rest position (20° from vertical) as shown in the figure.
(5) From the rest position to the switch point, lever torque measured at the end of the arm is 1.5 grams max.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

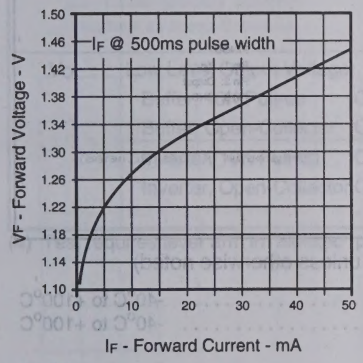
# Type OPB690

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

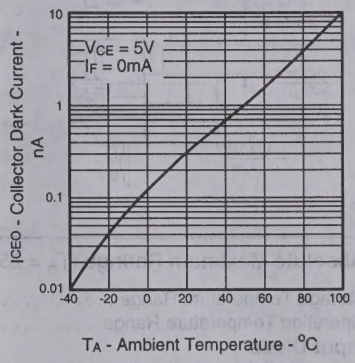
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.6 | V | $I_F$ = 10 mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 3.0 V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 100 µA |
| $I_{ECO}$ | Emitter Reverse Current | | 100 | µA | $V_{EC}$ = 0.4 V |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 5 V |
| **Coupled** | | | | | |
| $V_{SAT}$ | Saturation Voltage | | 0.4 | V | $I_F$ = 10 mA, $I_C$ = 100 µA, Gap unblocked |
| $I_{C(ON)}$ | On-State Collector Current | 600 | | µA | $I_F$ = 10 mA, $V_{CE}$ = 5 V |



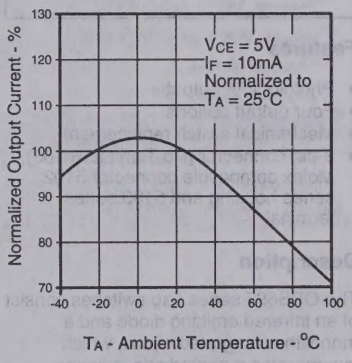
**Forward Current vs Forward Voltage Input Diode**



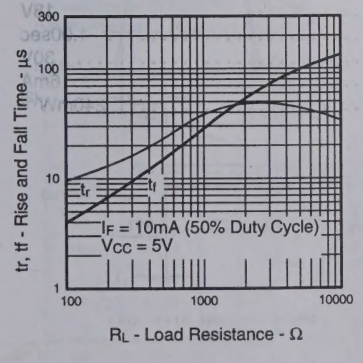

**Collector Dark Current vs Ambient Temperature**



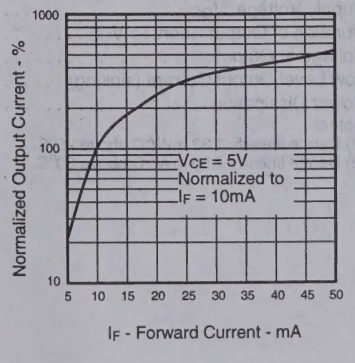

**Normalized Output Current vs Ambient Temperature**



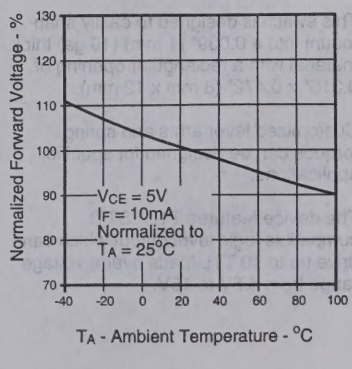

**Rise and Fall Time vs Load Resistance**



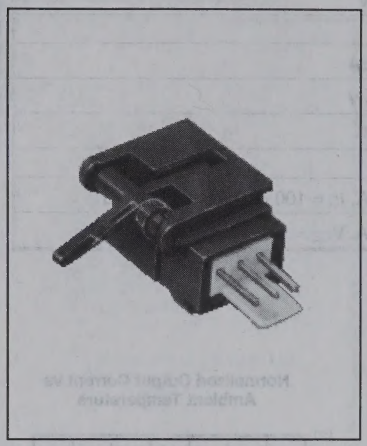

**Normalized Output Current vs Forward Current**

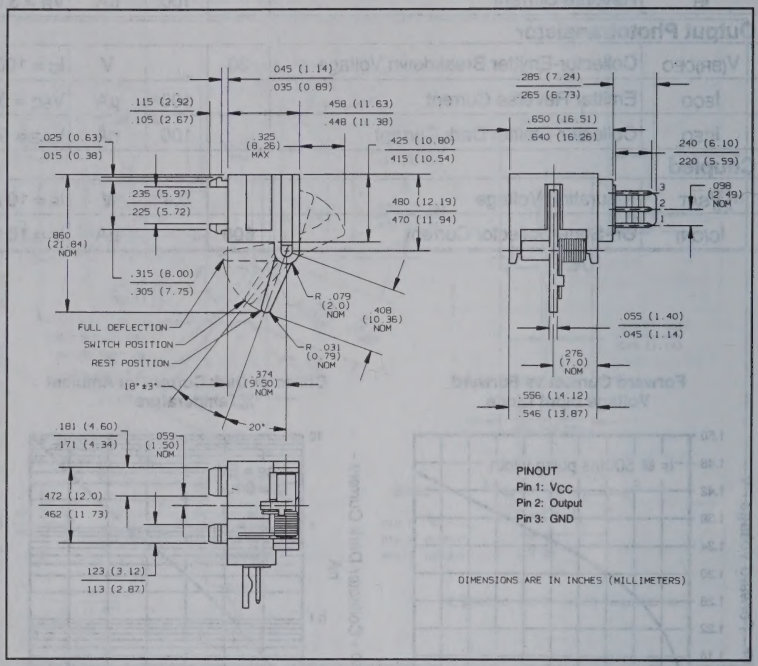



**Normalized Forward Voltage vs Ambient Temperature**



# Photologic™ Optical Flag Switch
## Types OPB695, OPB696, OPB697, OPB698 Series






### Features

- Photologic™ output
- Four output options
- Mechanical switch replacement
- 3-pin connector (Ho Tien L2561-03), Molex compatible connector 5102 series housing and 5103 series terminal

### Description

The OPB695 series flag switches consist of an infrared emitting diode and a monolithic integrated circuit, which incorporates a photodiode, a linear amplifier, and a Schmitt trigger. A lever arm actuated flag interrupts the light beam switching the output between states that can readily drive logic gates.

This switch is designed to easily snap mount into a 0.039" (1 mm) (19 ga) thick material with a rectangular opening of 0.315" x 0.472" (8 mm x 12 mm).

Customized lever arms and spring torques can be designed for specific applications.

The device features TTL/LSTTL compatible logic level output which can drive up to 10 TTL loads over a voltage range from 4.5V to 16V.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature Range | -40°C to +100°C |
| Operating Temperature Range | -40°C to +100°C |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 3.0V |
| Power Dissipation | 100mW(1) |
| **Output Photologic™** | |
| Supply Voltage, $V_{CC}$ | 18V |
| Duration of Output Short To $V_{CC}$ | 1.00sec |
| Voltage at Output | 30V |
| Low Level Output Current (sinking) | 16mA |
| Power Dissipation | 240mW(2) |

**Notes:**
(1) Derate linearly 1.33 mW/°C above 25°C.
(2) Derate linearly 2.50 mW/°C above 30°C.

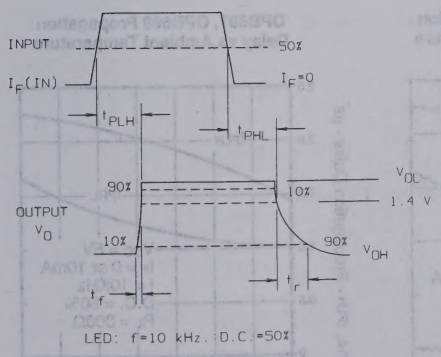
# Types OPB695, OPB696, OPB697, OPB698 Series

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | | | 1.6 | V | $I_F$ = 10mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 3.0V |
| **Output Photologic™ Sensor** | | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | | | | | | |
| | OPB695A, 696A, 697A, 698A | | 4.5 | 5.0 | 8.0 | V | |
| | OPB695B, 696B, 697B, 698B | | 8.0 | 12.0 | 13.5 | V | |
| | OPB695C, 696C, 697C, 698C | | 13.5 | 15.0 | 16.0 | V | |
| $I_{CC}$ | Operating Supply Current | | | 20.0 | 30.0 | mA | |
| $V_{OH}$ | High Level Output Voltage: | | | | | | |
| | Buffer, 10K Pull-up | OPB695A/B/C | $V_{CC}$-1.5 | | | V | $I_{OH}$ = 100µA, Unblocked |
| | Inverter, 10K Pull-up | OPB697A/B/C | $V_{CC}$-1.5 | | | V | $I_{OH}$ = 100µA, Blocked(4) |
| $I_{OH}$ | High Level Output Current: | | | | | | |
| | Buffer, Open-Collector | OPB696A | | | 100 | µA | $V_{CC}$ = 4.5 to 8V, $V_{OH}$ = 30V, Unblocked |
| | | OPB696B | | | 100 | µA | $V_{CC}$ = 8 to 13.5V, $V_{OH}$ = 30V, Unblocked |
| | | OPB696C | | | 100 | µA | $V_{CC}$ = 13.5 to 16V, $V_{OH}$ = 30V, Unblocked |
| | Inverter, Open-Collector | OPB698A | | | 100 | µA | $V_{CC}$ = 4.5 to 8V, $V_{OH}$ = 30V, Blocked(4) |
| | | OPB698B | | | 100 | µA | $V_{CC}$ = 8 to 13.5V, $V_{OH}$ = 30V, Blocked(4) |
| | | OPB698C | | | 100 | µA | $V_{CC}$ = 13.5 to 16V, $V_{OH}$ = 30V, Blocked(4) |
| $V_{OL}$ | Low Level Output Voltage: | | | | | | $V_{CC}$ = 4.5 to 8V, $I_{OL}$ = 16mA, Blocked(4) |
| | Buffer, 10K Pull-up | OPB695A/B/C | | | 0.4 | V | $V_{CC}$ = 8 to 13.5V, $I_{OL}$ = 16mA, Blocked(4) |
| | Buffer, Open-Collector | OPB696A/B/C | | | | | $V_{CC}$ = 13.5 to 16V, $I_{OL}$ = 16mA, Blocked(4) |
| | Inverter, 10K Pull-up | OPB697A/B/C | | | | | $V_{CC}$ = 4.5 to 8V, $I_{OL}$ = 16mA, Unblocked |
| | Inverter, Open-Collector | OPB698A/B/C | | | 0.4 | V | $V_{CC}$ = 8 to 13.5V, $I_{OL}$ = 16mA, Unblocked |
| | | | | | | | $V_{CC}$ = 13.5 to 16V, $I_{OL}$ = 16mA, Unblocked |

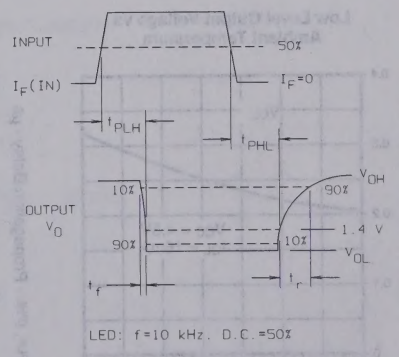
(4) Test requires lever arm in "blocked" position .

SWITCHING TEST CURVE FOR BUFFERS




LED: f=10 kHz. D.C.=50%

SWITCHING TEST CURVE FOR INVERTERS

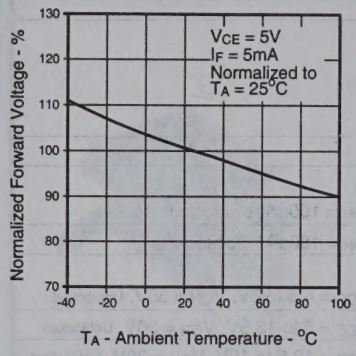



LED: f=10 kHz. D.C.=50%

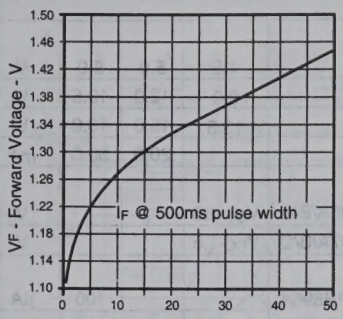
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

## Typical Performance Curves

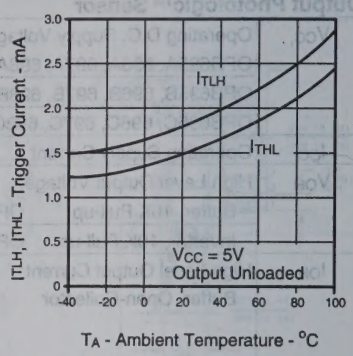
**Normalized Forward Voltage vs Ambient Temperature**



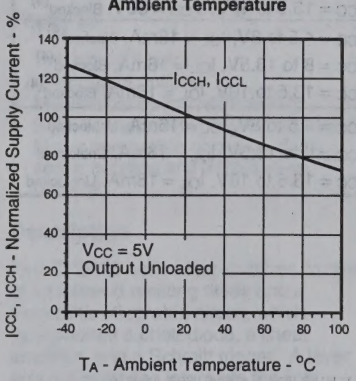

**Forward Current vs Forward Voltage Input Diode**



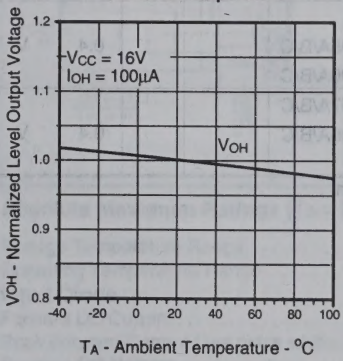

**Trigger Current vs Ambient Temperature**



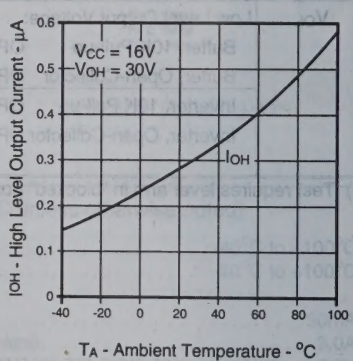

**Normalized Supply Current vs Ambient Temperature**



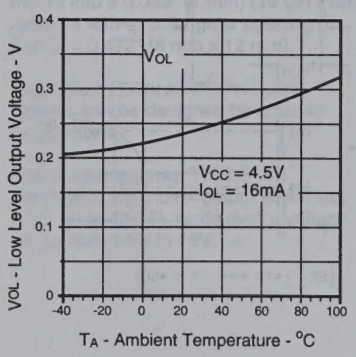

**OPB695, OPB697 Normalized High Level Output Voltage vs Ambient Temperature**



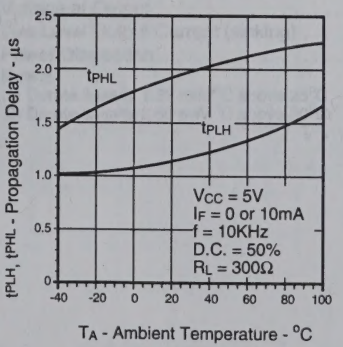

**OPB696, OPB698 High Level Output Current vs Ambient**



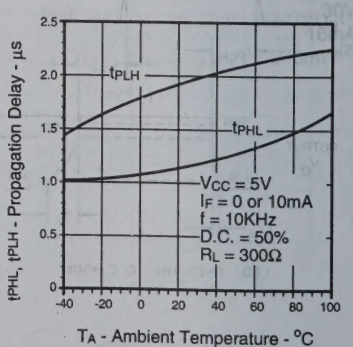

**Low Level Output Voltage vs Ambient Temperature**




**OPB695, OPB696 Propagation Delay vs Ambient Temperature**

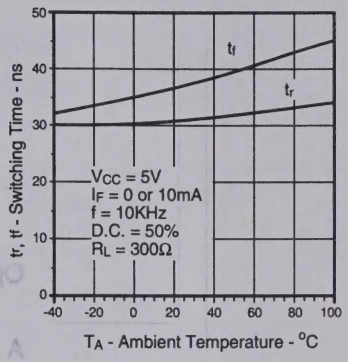



**OPB697, OPB698 Propagation Delay vs Ambient Temperature**

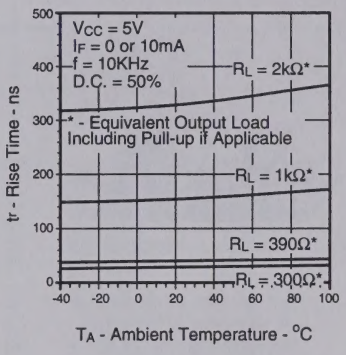


## Typical Performance Curves

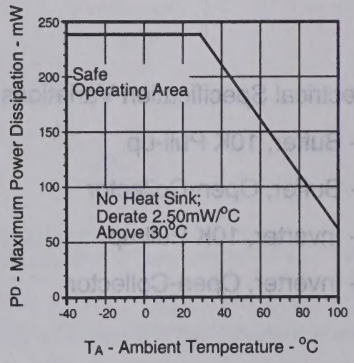
**Switching Time vs Ambient Temperature**




**Rise Time vs Output Load vs Ambient Temperature**




**Typical Thermal Derating Curve**



# PART NUMBER GUIDE

**OPB 6 9 X X**

Operating D.C. Supply Voltage:

A - 4.5V ≤ $V_{CC}$ ≤ 8.0V
B - 8.0V ≤ $V_{CC}$ ≤ 13.5V
C - 13.5V ≤ $V_{CC}$ ≤ 16.0V

Electrical Specification Variations:

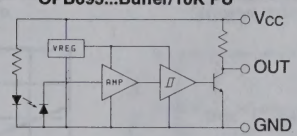
5 - Buffer, 10K Pull-up

6 - Buffer, Open-Collector

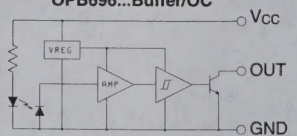
7 - Inverter, 10K Pull-up

8 - Inverter, Open-Collector

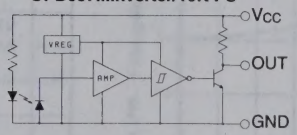
**OPB695...Buffer/10K PU**



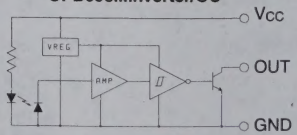

**OPB696...Buffer/OC**

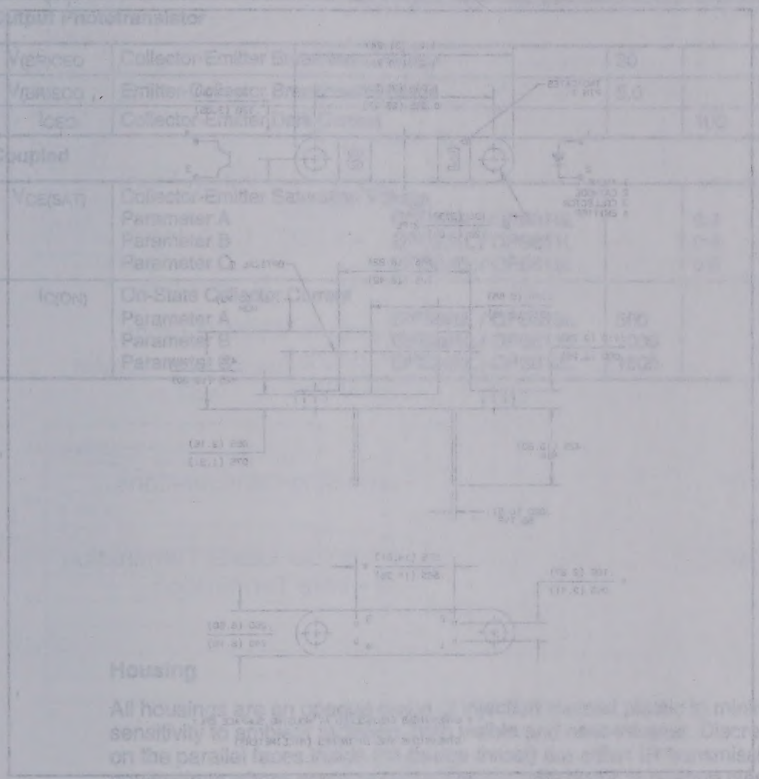


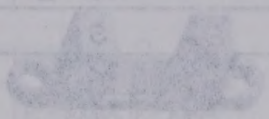

**OPB697...Inverter/10K PU**



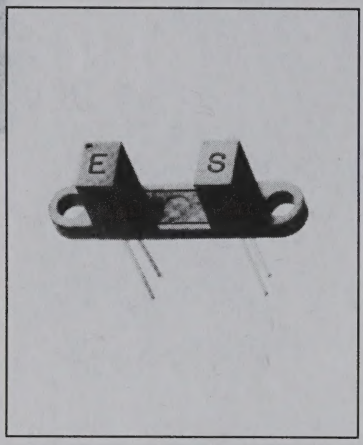

**OPB698...Inverter/OC**

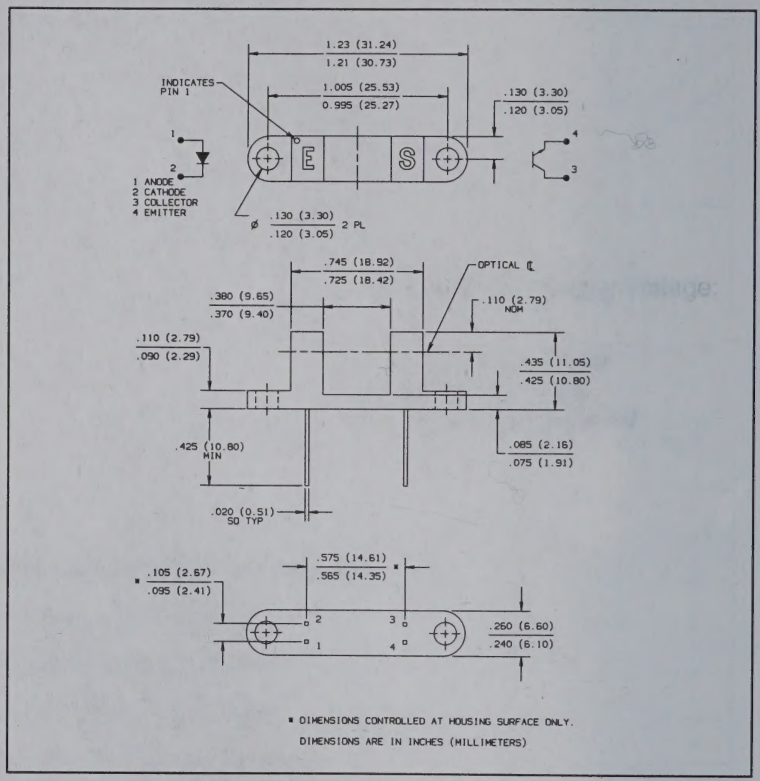






# Wide Gap Slotted Optical Switches
## Types OPB800L, OPB810L Series




### Features

- 0.375" wide gap
- Choice of aperture size
- Choice of minimum photocurrent
- Choice of opaque or IR transmissive shells
- 0.570" lead spacing

### Description

The OPB800L/OPB810L series of wide gap slotted switches provides the design engineer with the flexibility of a custom device from a standard product line. Building from a standard housing utilizing a .375" wide slot, the user can specify (1) electrical output parameters, (2) discrete shell material and (3) aperture width. Available with wire leads as OPB800W/OPB810W.

### Replaces

KT800L - KT810L series

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +85°C(1) |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 100mW(1) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 30mA |
| Power Dissipation | 100mW(1) |

**Notes:**
(1) Derate linearly 1.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

# Types OPB800L, OPB810L Series

**Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)**

| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | 100 | nA | $V_{CE}$ = 10.0V |
| **Coupled** | | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | | | |
| | Parameter A | OPB800L / OPB810L | | 0.4 | V | $I_C$ = 250µA, $I_F$ = 20mA |
| | Parameter B | OPB801L / OPB811L | | 0.4 | V | $I_C$ = 500µA, $I_F$ = 10mA |
| | Parameter C | OPB802L / OPB812L | | 0.6 | V | $I_C$ = 1800µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | | | | | |
| | Parameter A | OPB800L / OPB810L | 500 | | µA | $V_{CE}$ = 10.0V, $I_F$ = 20.0mA |
| | Parameter B | OPB801L / OPB811L | 1000 | | µA | $V_{CE}$ = 5.0V, $I_F$ = 10.0mA |
| | Parameter C | OPB802L / OPB812L | 1800 | | µA | $V_{CE}$ = 0.6V, $I_F$ = 20.0mA |

### Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed only on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic with aperture openings for maximum protection against ambient light.



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# PART NUMBER GUIDE

OPB 8 X X X X X

Optek Assembly

Phototransistor Output Family

Discrete Shell Material Designation

0 - Transmissive Plastic Discrete Shell

1 - Opaque Plastic Discrete Shell

Aperture Width In Front of Sensor
5 = 0.050" 1 = 0.010"*

Aperture Width In Front of Emitter
5 = 0.050"

Mounting Configurations

L - Solder Leads Termination
W - Wire Termination

Mechanical And Electrical Specification Variations

0 - Electrical Parameter A

1 - Electrical Parameter B

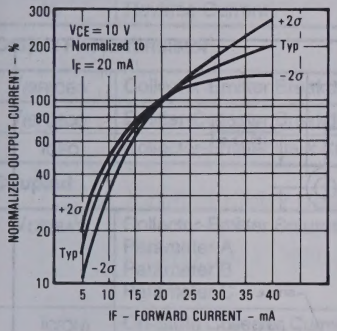
2 - Electrical Parameter C

*Assemblies with 0.010" apertures are currently available with electrical parameter "A" only.

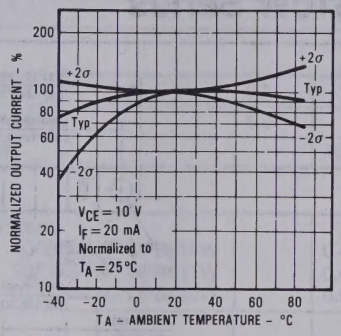
# Types OPB800L, OPB810L Series

## Typical Performance Curves

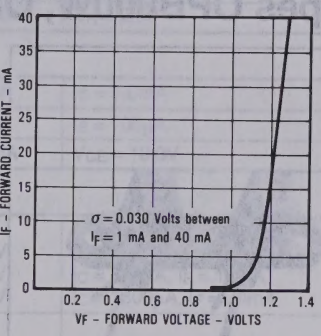
### Normalized Output Current vs Forward Current



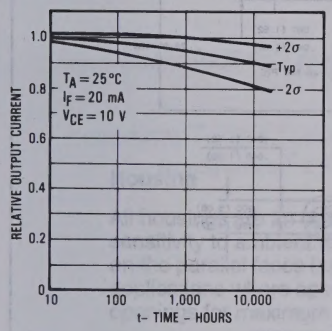

### Normalized Output Current vs Ambient Temperature



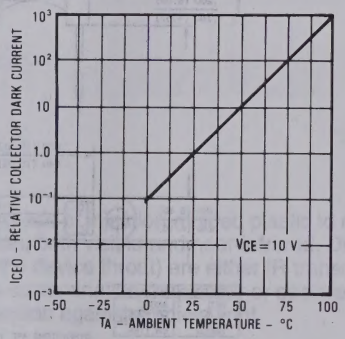

### Forward Current vs Forward Voltage Input Diode



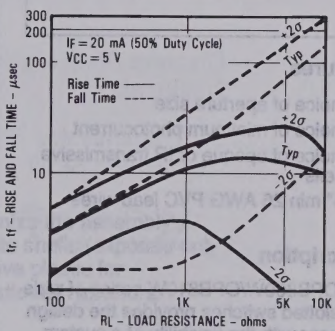

### Relative Output Current vs Time




### Collector Dark Current vs Ambient Temperature

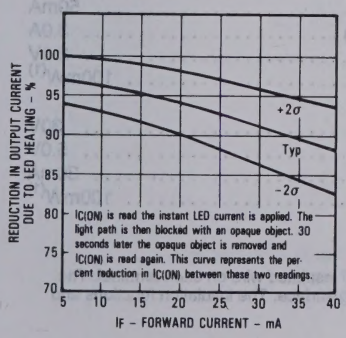



### Rise and Fall Time vs Load Resistance

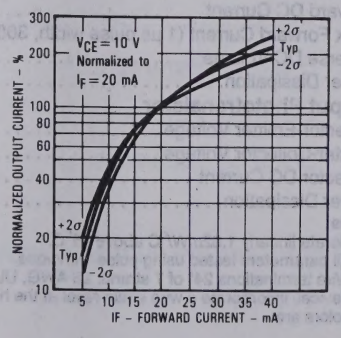



## All Part Numbers Ending in "1"

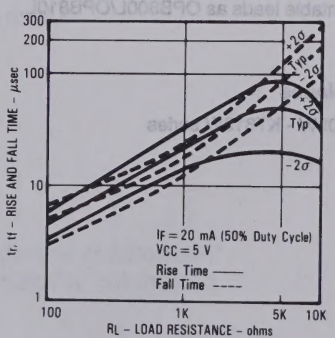
### Reduction in Output Current Due to LED Heating vs Forward Current


+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the per cent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

### Normalized Output Current vs Input Current



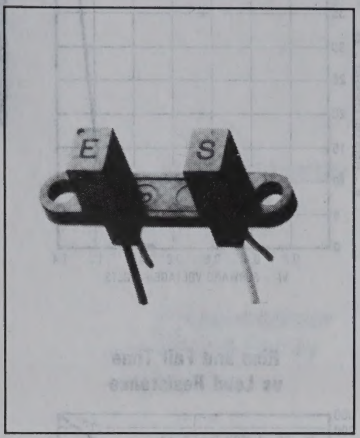

### Rise and Fall Time vs Load Resistance

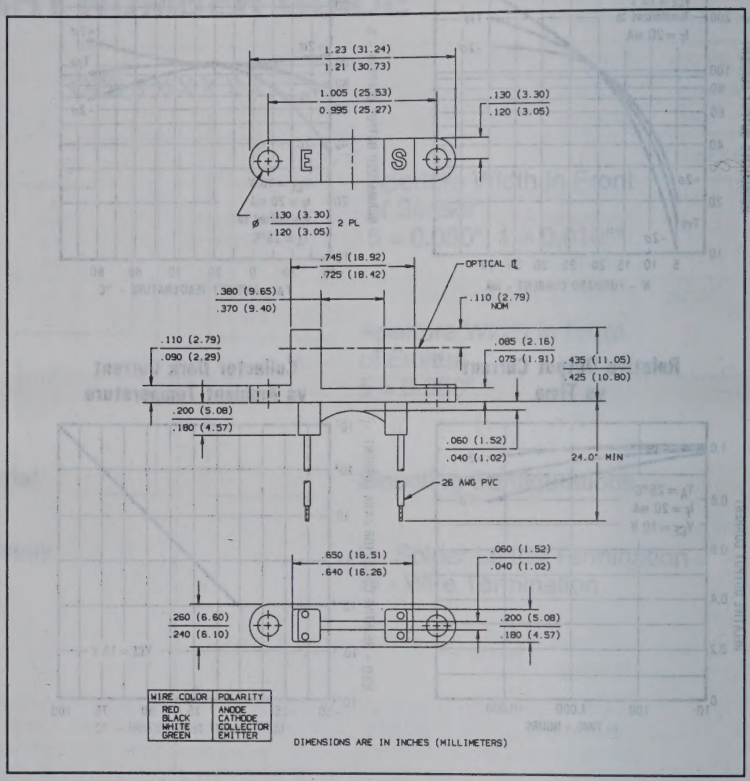



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Wide Gap Slotted Optical Switches
## Types OPB800W, OPB810W Series




### Features

- Choice of aperture size
- Choice of minimum photocurrent
- Choice of opaque or IR transmissive shells
- 24" min 26 AWG PVC lead wires

### Description

The OPB800W/OPB810W series of wide gap slotted switches provides the design engineer with the flexibility of a custom device from a standard product line. Building from a standard housing utilizing a .375" wide slot, the user can specify (1) electrical output parameters, (2) discrete shell material and (3) aperture width. Available with PC board mountable leads as OPB800L/OPB810L.

### Replaces

KT800W - KT810W series

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +80°C

**Input Diode**

Forward DC Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 100mW(1)

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Collector DC Current ..... 30mA
Power Dissipation ..... 100mW(1)

**Notes:**

(1) Derate linearly 1.82mW/°C above 25°C.
(2) All parameters tested using pulse technique.
(3) Wire terminations 24" of 7 strand, 26 AWG, UL 1429 insulated wire on each terminal. The devices incorporate a wire strain relief at the housing surface. The insulation functions and colors are:

RED - IRED Anode
BLACK - IRED Cathode
WHITE - Phototransistor Collector
GREEN - Phototransistor Emitter

Other wire lengths and/or colors differing from the standard series are available.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB800W, OPB810W Series

**Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)**

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | | |
| | Parameter A OPB800W / OPB810W | | 0.4 | V | $I_C$ = 250µA, $I_F$ = 20mA |
| | Parameter B OPB801W / OPB811W | | 0.4 | V | $I_C$ = 500µA, $I_F$ = 10mA |
| | Parameter C OPB802W / OPB812W | | 0.6 | V | $I_C$ = 1800µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | | | | |
| | Parameter A OPB800W / OPB810W | 500 | | µA | $V_{CE}$ = 10.0V, $I_F$ = 20.0mA |
| | Parameter B OPB801W / OPB811W | 1000 | | µA | $V_{CE}$ = 5.0V, $I_F$ = 10.0mA |
| | Parameter C OPB802W / OPB812W | 1800 | | µA | $V_{CE}$ = 0.6V, $I_F$ = 20.0mA |

### Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed only on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic with aperture openings for maximum protection against ambient light.



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Types OPB800W, OPB810W Series

## PART NUMBER GUIDE

OPB 8 X X X X X

Optek Assembly

Phototransistor Output Family

Discrete Shell Material Designation

0 - Transmissive Plastic Discrete Shell

1 - Opaque Plastic Discrete Shell

Aperture Width In Front of Sensor
5 = 0.050" 1 = 0.010"*

Aperture Width In Front of Emitter
5 = 0.050"

Mounting Configurations

L - Solder Leads Termination
W - Wire Termination

Mechanical And Electrical Specification Variations

0 - Electrical Parameter A

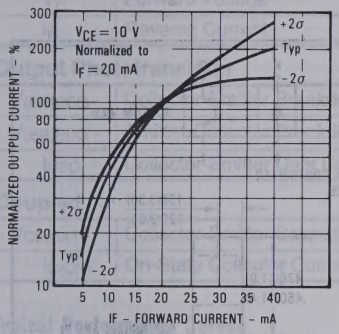
1 - Electrical Parameter B

2 - Electrical Parameter C

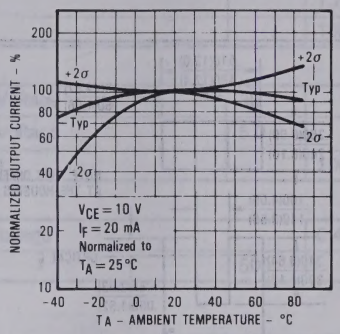
*Assemblies with 0.010" apertures are currently available with electrical parameter "A" only.

## Typical Performance Curves

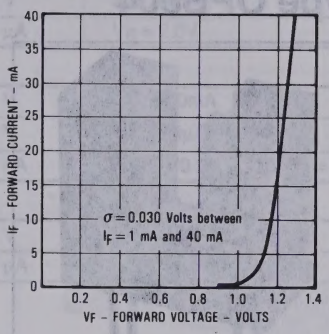
### Normalized Output Current vs Forward Current



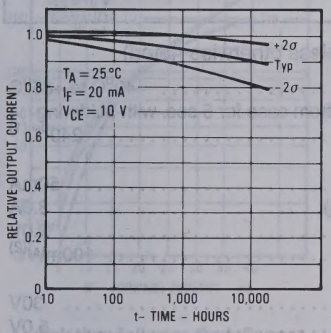

### Normalized Output Current vs Ambient Temperature



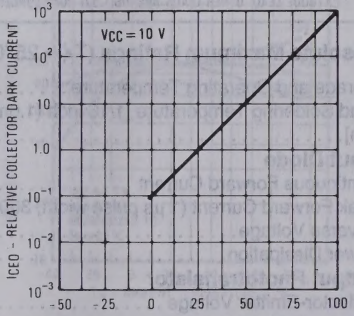

### Forward Current vs Forward Voltage Input Diode



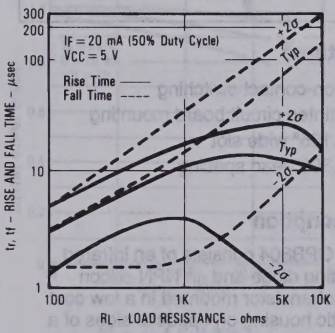

### Relative Output Current vs Time




### Collector Dark Current vs Ambient Temperature

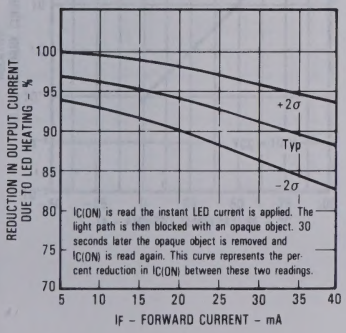



### Rise and Fall Time vs Load Resistance

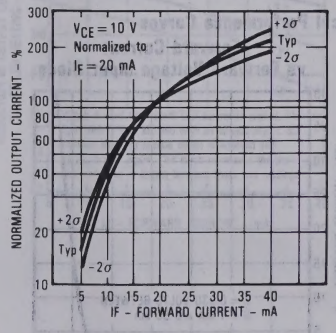



## All Part Numbers Ending in "1"

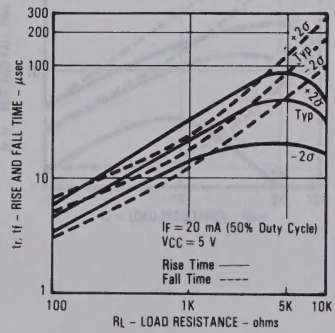
### Reduction in Output Current Due to LED Heating vs Forward Current


+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

### Normalized Output Current vs Input Current

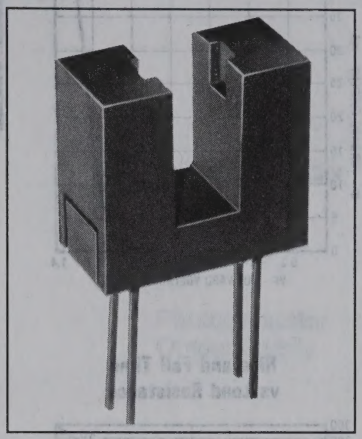


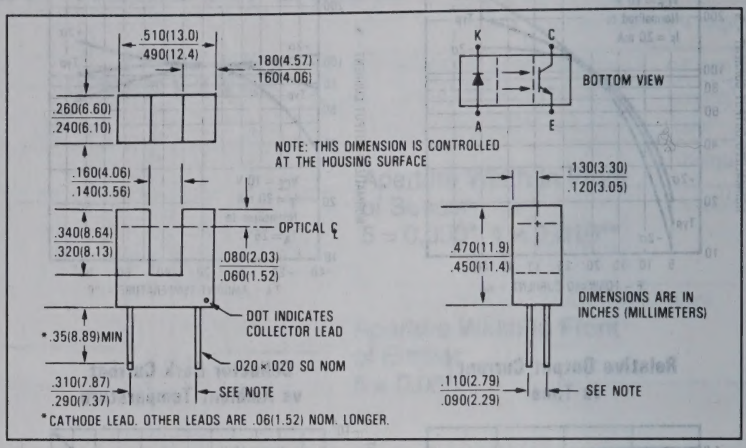

### Rise and Fall Time vs Load Resistance




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Slotted Optical Switch
## Type OPB804






### Features

- Non-contact switching
- Printed circuit board mounting
- 0.155" wide slot
- 0.300" lead spacing

### Description

The OPB804 consists of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost plastic housing on opposite sides of a 0.155" (3.94mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Continuous Forward Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

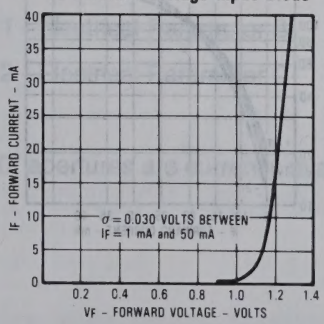
**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

### Typical Performance Curves

**Forward Current vs Forward Voltage Input Diode**



# Type OPB804

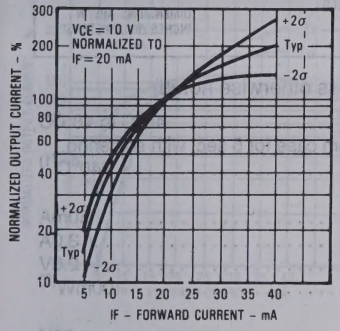
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 1.00mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.40 | V | $I_C$ = 250µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | 500 | | µA | $V_{CE}$ = 10.0V, $I_F$ = 20mA |

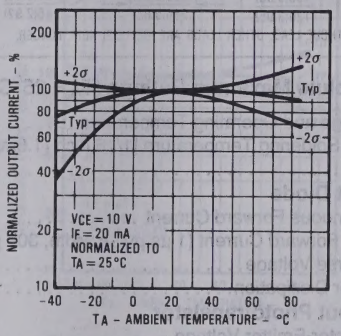


## Typical Performance Curves

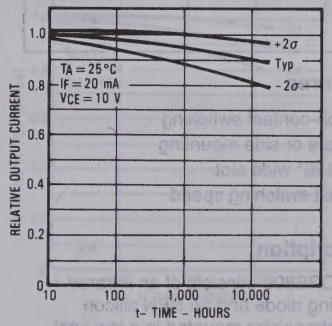
**Normalized Output Current vs Forward Current**



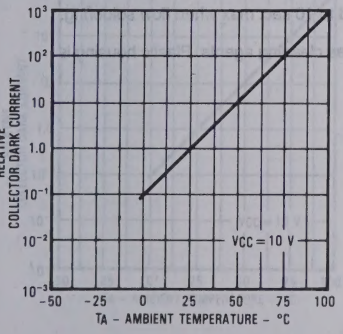

**Normalized Output Current vs Ambient Temperature**



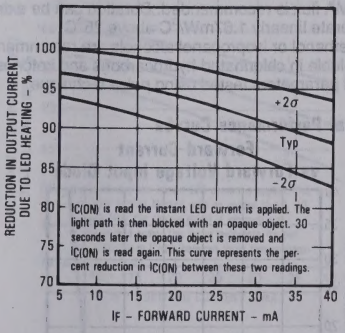

**Relative Output Current vs Time**



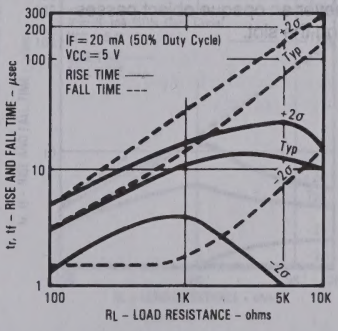

**Relative Collector Dark Current vs Ambient Temperature**




**Reduction in Output Current Due to LED Heating vs Forward Current**

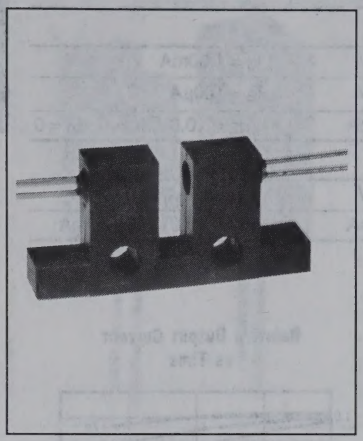

+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

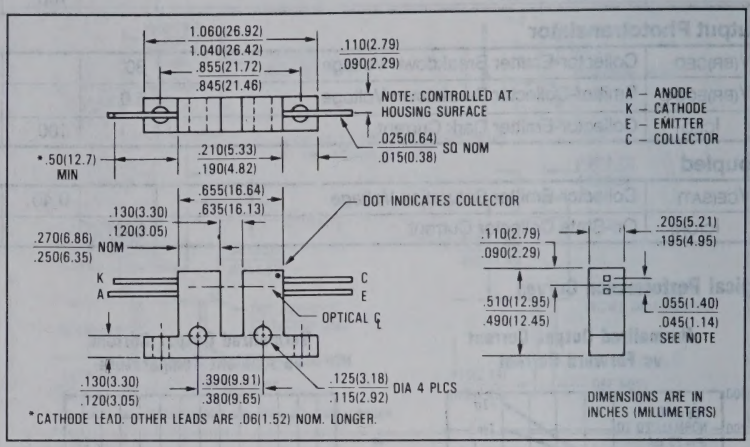
**Rise and Fall Time vs Load Resistance**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Slotted Optical Switch
## Type OPB806






### Features

- Non-contact switching
- Base or side mounting
- 0.125" wide slot
- Fast switching speed

### Description

The OPB806 consists of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost plastic housing on opposite sides of a 0.125" (3.18mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Continuous Forward Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

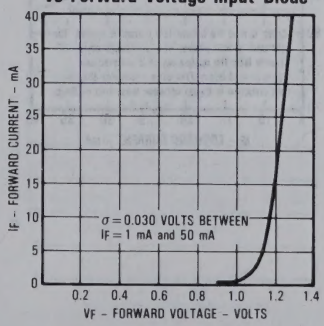
**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

**Typical Performance Curves**

**Forward Current vs Forward Voltage Input Diode**



# Type OPB806

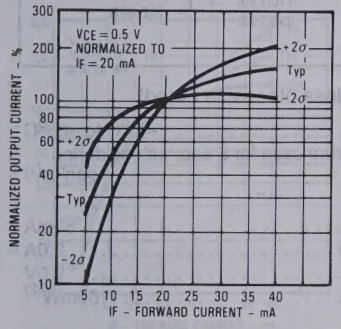
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 100µA, |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA, |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.50 | V | $I_C$ = 200µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | 0.40 | | mA | $V_{CE}$ = 0.5V, $I_F$ = 20mA |

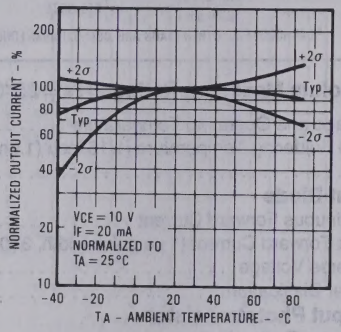


## Typical Performance Curves

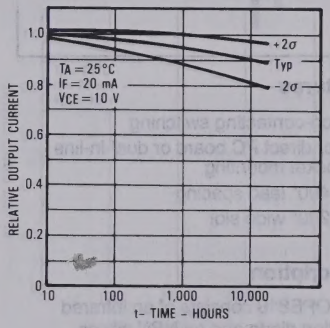
**Normalized Output Current vs Forward Current**



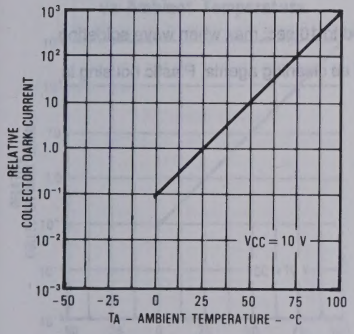

**Normalized Output Current vs Ambient Temperature**



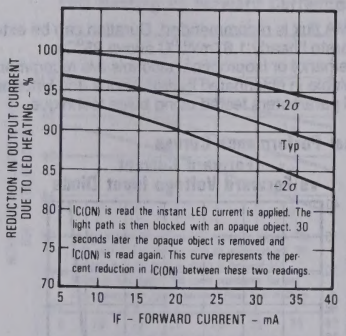

**Relative Output Current vs Time**



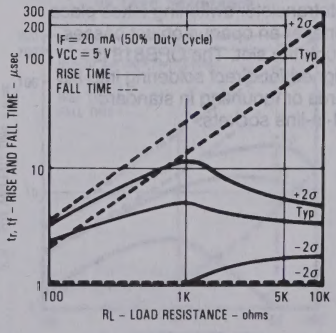

**Relative Collector Dark Current vs Ambient Temperature**




**Reduction in Output Current Due to LED Heating vs Forward Current**


+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

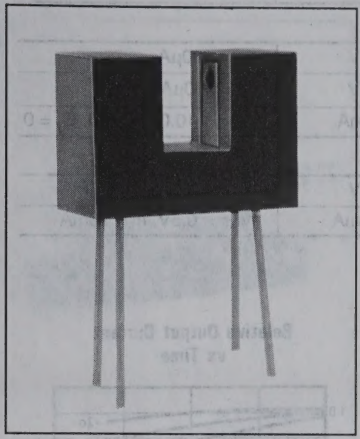
**Rise and Fall Time vs Load Resistance**

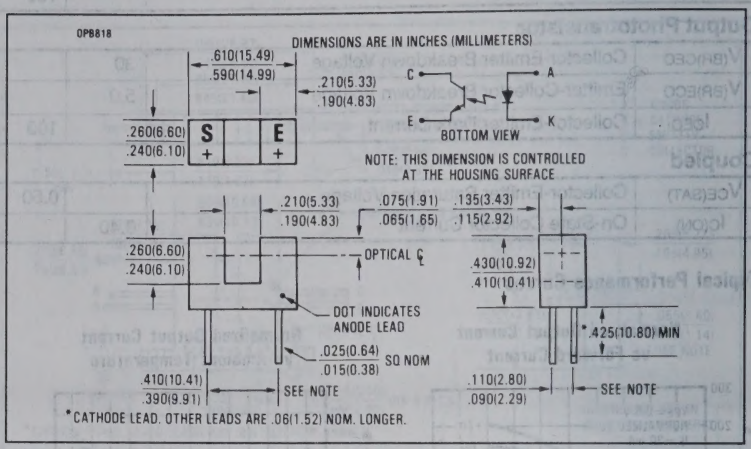



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Slotted Optical Switch
## Type OPB818






### Features

- Non-contacting switching
- For direct PC board or dual-in-line socket mounting
- 0.400" lead spacing
- 0.200" wide slot

### Description

The OPB818 consists of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost black plastic housing on opposite sides of a 0.200" (5.08mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot. The OPB818 is designed for direct soldering into PC Boards or mounting in standard dual-in-line sockets.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Continuous Forward Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

**Output Phototransistor**

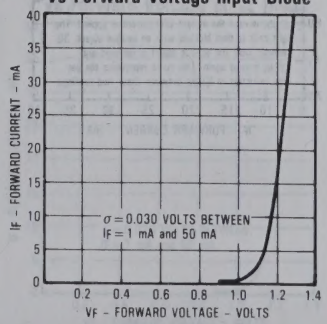
Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

**Notes:**

(1) RMA flux is recommended. Duration can be extended to 10 sec. max when wave soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

**Typical Performance Curves**

Forward Current vs Forward Voltage Input Diode



# Type OPB818

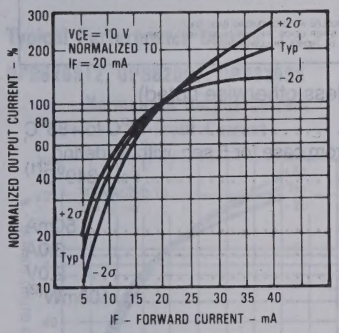
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 1.00mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.40 | V | $I_C$ = 50µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | 100 | | µA | $V_{CE}$ = 10.0V, $I_F$ = 20mA |

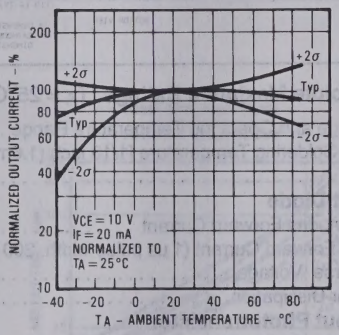


## Typical Performance Curves

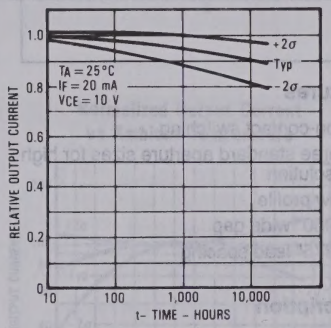
**Normalized Output Current vs Forward Current**



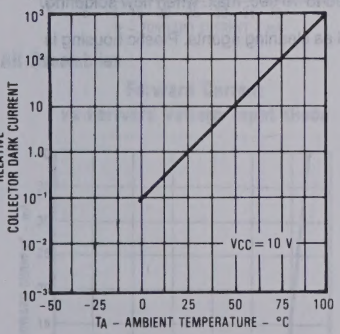

**Normalized Output Current vs Ambient Temperature**



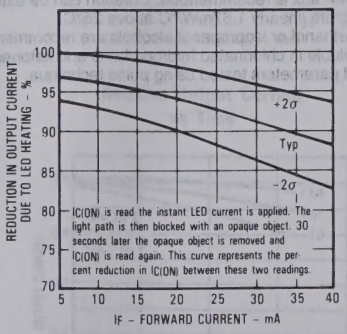

**Relative Output Current vs Time**



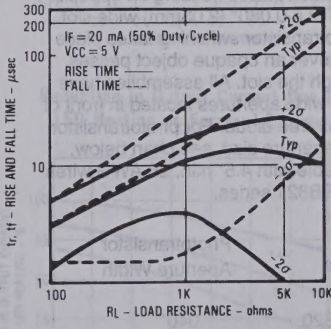

**Relative Collector Dark Current vs Ambient Temperature**




**Reduction in Output Current Due to LED Heating vs Forward Current**

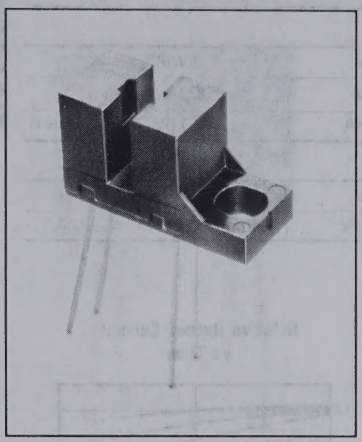

+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

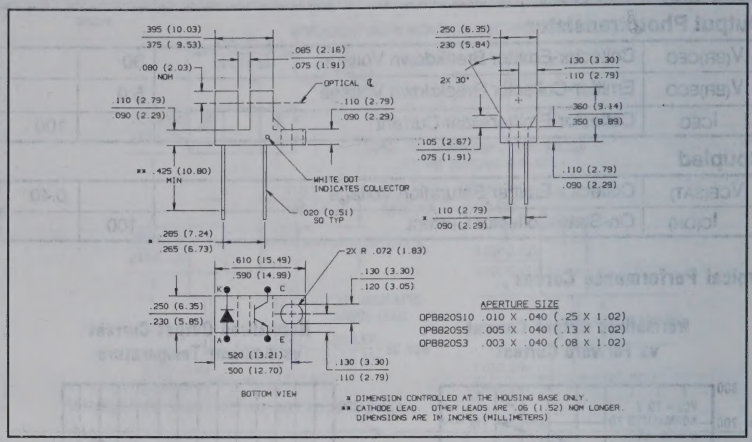
**Rise and Fall Time vs Load Resistance**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Slotted Optical Switches
## Types OPB820, OPB820S10, OPB820S5, OPB820S3






### Features

- Non-contact switching
- Three standard aperture sizes for high resolution
- Low profile
- 0.080" wide gap
- 0.275" lead spacing

### Description

The OPB820, OPB820S10, OPB820S5, and OPB820S3 each consist of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost black plastic housing on opposite sides of a 0.080" (2.03mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot. All assemblies have .040" wide apertures located in front of the infrared diode. For phototransistor side aperture size, see chart below. Available with 4.5" min, 26 AWG wires as OPB821 series.

| OPB# | Phototransistor Aperture Width |
|---|---|
| OPB820 | .040" |
| OPB820S10 | .010" |
| OPB820S5 | .005" |
| OPB820S3 | .003" |

### Replaces

OPB820S12, OPB820S7, KT8155

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

### Input Diode

Continuous Forward Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

### Output Phototransistor

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB820, OPB820S10, OPB820S5, OPB820S3

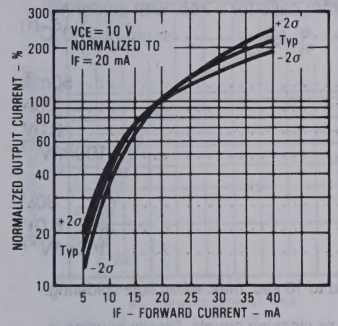
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | | | 1.70 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | | 30 | | V | $I_C$ = 1.00mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | OPB820 | | | 0.4 | V | $I_C$ = 250µA, $I_F$ = 20mA |
| | | OPB820S10 | | | 0.4 | V | $I_C$ = 250µA, $I_F$ = 20mA |
| | | OPB820S5 | | | 0.4 | V | $I_C$ = 125µA, $I_F$ = 20mA |
| | | OPB820S3 | | | 0.4 | V | $I_C$ = 40µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | OPB820 | 500 | | | µA | $V_{CE}$ = 5.0V, $I_F$ = 20mA |
| | | OPB820S10 | 400 | | | µA | $V_{CE}$ = 5.0V, $I_F$ = 20mA |
| | | OPB820S5 | 300 | | | µA | $V_{CE}$ = 5.0V, $I_F$ = 20mA |
| | | OPB820S3 | 60 | | | µA | $V_{CE}$ = 5.0V, $I_F$ = 20mA |

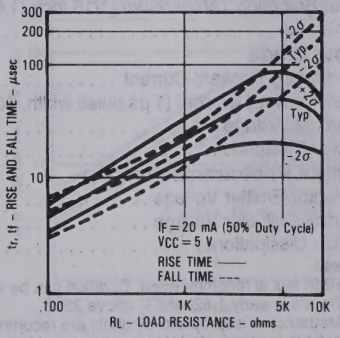
## Typical Performance Curves

### OPB820S12, OPB820S7, OPB820S5

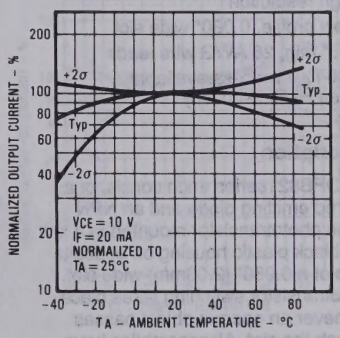
**Normalized Output Current vs Input Current**




**Rise and Fall Time vs Load Resistance**

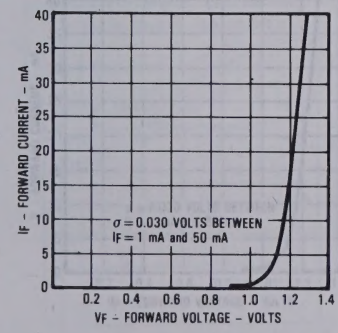



**Normalized Output Current vs Ambient Temperature**

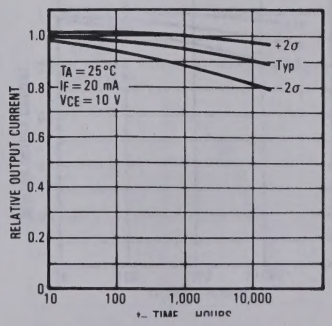



### All Assemblies

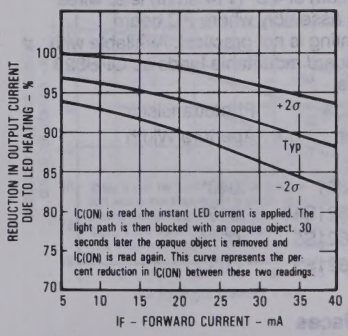
**Forward Current vs Forward Voltage Input Diode**




**Relative Output Current vs Time**



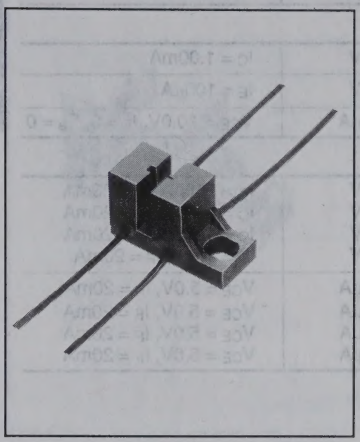

**Reduction in Output Current Due to LED Heating vs Forward Current**

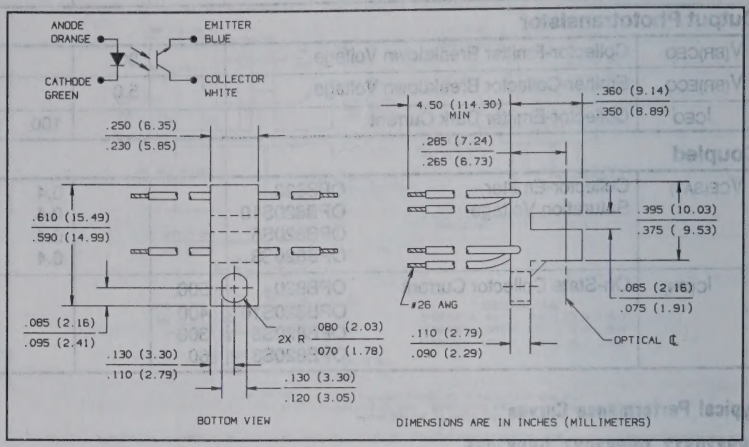

REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
IF - FORWARD CURRENT - mA

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Slotted Optical Switches
## Types OPB821, OPB821S10, OPB821S5, OPB821S3






### Features

- Three standard aperture sizes for high resolution
- Low profile, 0.080" wide slot
- 4.5" min, 26 AWG wire leads
- TX-TXV process available (see Hi-Rel section)

### Description

The OPB821series each consist of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost black plastic housing on opposite sides of a 0.080" (2.03mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot. All assemblies have .040" wide apertures located in front of the infrared diode. For phototransistor side aperture size, see chart below. A minimum of 4.5" (114.3mm) lead wires ease assembly where PC board mounting is not practical. Available with PC board mountable leads as OPB820 series.

| OPB# | Phototransistor Aperture Width |
|---|---|
| OPB821 | .040" |
| OPB821S10 | .010" |
| OPB821S5 | .005" |
| OPB821S3 | .003" |

### Replaces

OPB821S12, OPB821S7, KT8165

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +80°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

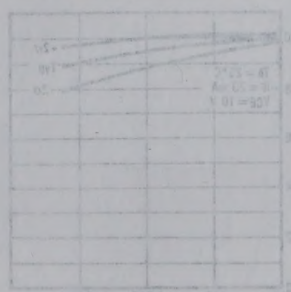
**Input Diode**

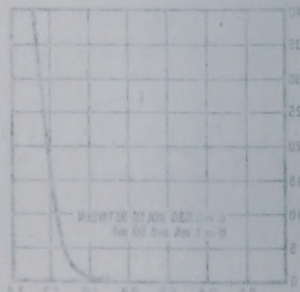
Continuous Forward Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.82mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.





Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB821, OPB821S10, OPB821S5, OPB821S3

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

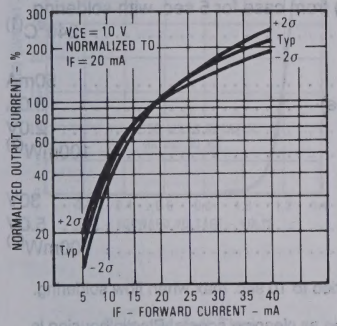
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_C$ = 1.00mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | OPB821 | | 0.4 | V | $I_C$ = 250µA, $I_F$ = 20mA |
| | | OPB821S10 | | 0.4 | V | $I_C$ = 250µA, $I_F$ = 20mA |
| | | OPB821S5 | | 0.4 | V | $I_C$ = 125µA, $I_F$ = 20mA |
| | | OPB821S3 | | 0.4 | V | $I_C$ = 40µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | OPB821 | 500 | | µA | $V_{CE}$ = 5.0V, $I_F$ = 20mA |
| | | OPB821S10 | 400 | | µA | $V_{CE}$ = 5.0V, $I_F$ = 20mA |
| | | OPB821S5 | 300 | | µA | $V_{CE}$ = 5.0V, $I_F$ = 20mA |
| | | OPB821S3 | 60 | | µA | $V_{CE}$ = 5.0V, $I_F$ = 20mA |



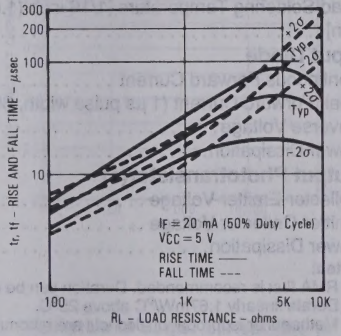
## Typical Performance Curves

### OPB821, OPB821S10, OPB821S5, OPB821S3

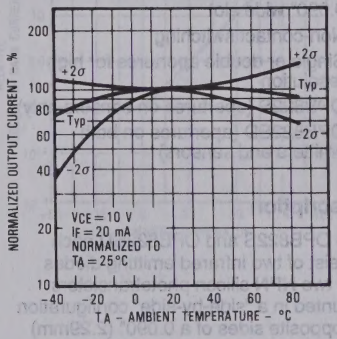
**Normalized Output Current vs Input Current**




**Rise and Fall Time vs Load Resistance**

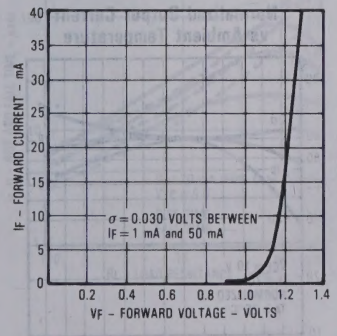



**Normalized Output Current vs Ambient Temperature**

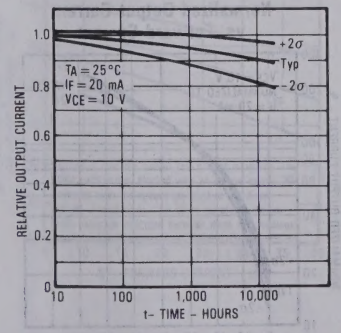



### All Assemblies

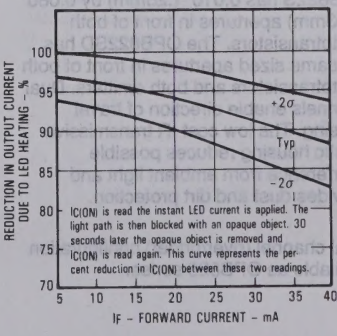
**Forward Current vs Forward Voltage Input Diode**




**Relative Output Current vs Time**



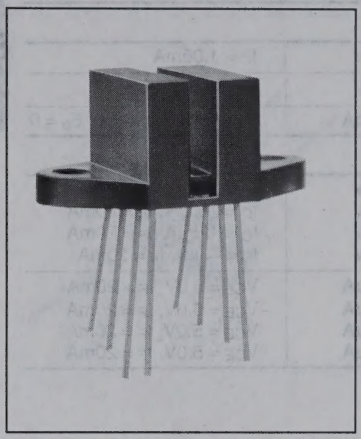

**Reduction in Output Current Due to LED Heating vs Forward Current**

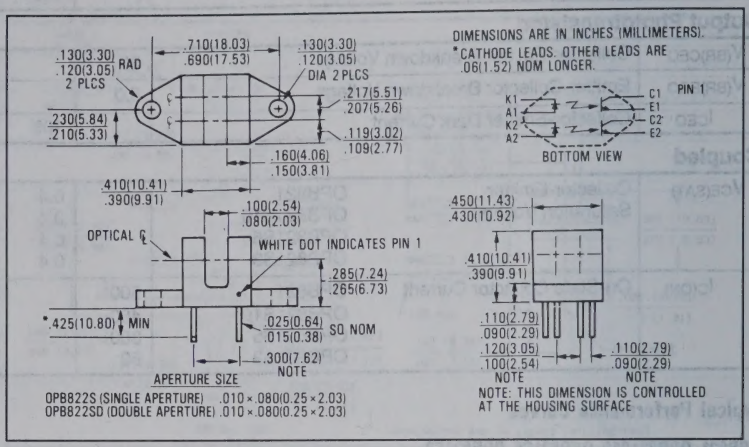

IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
+2σ
Typ
-2σ
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Dual Channel Slotted Optical Switches
## Types OPB822S, OPB822SD






### Features

- Dual channels side-by-side
- 0.090" wide slot
- Non-contact switching
- Single or double apertures for high resolution
- OPB822S (apertures on sensors only)
- OPB822SD (apertures on both emitters and sensors)

### Description

The OPB822S and OPB822SD each consist of two infrared emitting diodes and two NPN silicon phototransistors mounted in a "side-by-side" configuration on opposite sides of a 0.090" (2.29mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the device slot. The OPB822S has 0.010" (.25mm) by 0.080" (2.03mm) apertures in front of both phototransistors. The OPB822SD has the same sized apertures in front of both phototransistors and both emitters. Dual channels enable direction of travel sensing. The low cost IR transmissive plastic housing reduces possible interference from ambient light and provides dust and dirt protection.

Dual channel (over/under) configuration available as OPB826 series.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Continuous Forward Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

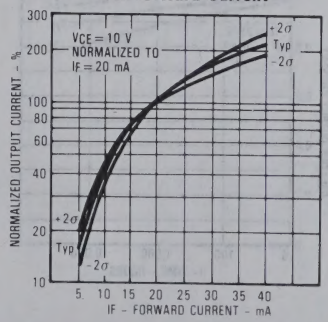
**Output Phototransistor(s)**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

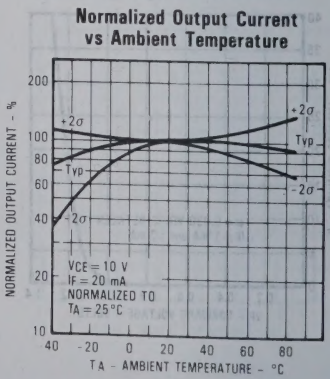
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

**Typical Performance Curves**

**Normalized Output Current vs. Forward Current**




**Normalized Output Current vs Ambient Temperature**



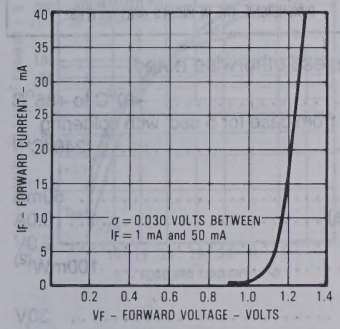
# Types OPB822S, OPB822SD

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

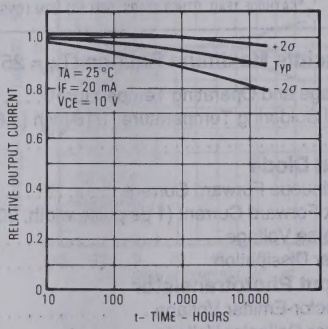
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | OPB822S<br>OPB822SD | | 0.40<br>0.40 | V<br>V | $I_C$ = 125µA, $I_F$ = 20mA<br>$I_C$ = 50µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | OPB822S<br>OPB822SD | 250<br>100 | | µA<br>µA | $V_{CE}$ = 10.0V, $I_F$ = 20mA<br>$V_{CE}$ = 10.0V, $I_F$ = 20mA |

**Typical Performance Curves (All Assemblies)**

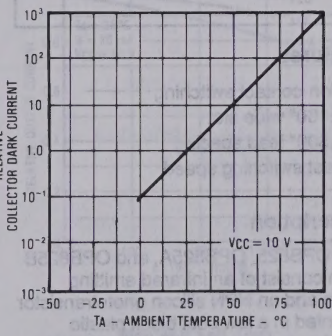
**Forward Current vs Forward Voltage Input Diode**



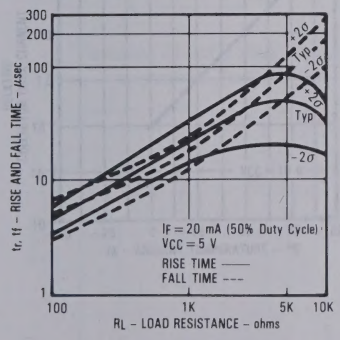

**Relative Output Current vs Time**



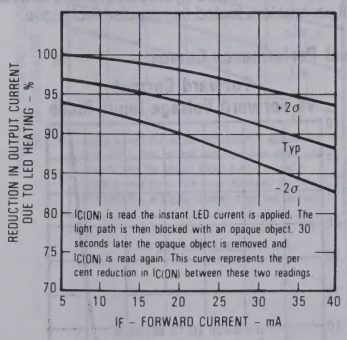

**Relative Collector Dark Current vs Ambient Temperature**




**Rise and Fall Time vs Load Resistance**




**Reduction in Output Current Due to LED Heating vs Forward Current**


REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING – %
+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the per cent reduction in IC(ON) between these two readings.
IF – FORWARD CURRENT – mA

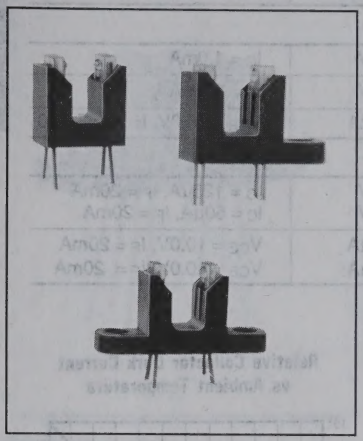


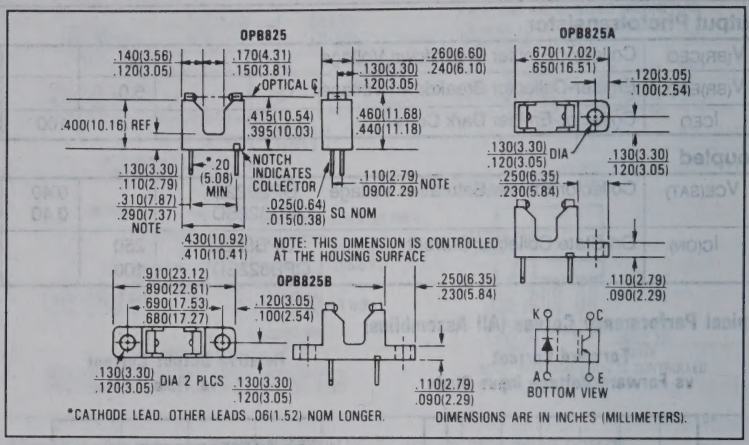
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# Slotted Optical Switches
## Types OPB825, OPB825A, OPB825B






### Features

- Non-contact switching
- 0.160" wide slot
- 0.300" lead spacing
- Fast switching speed

### Description

The OPB825, OPB825A, and OPB825B each consist of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost black plastic housing on opposite sides of a 0.160" (4.06mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot. The OPB825 has no mounting tabs and is intended for direct insertion into PC boards or dual-in-line sockets. The OPB825A has a single mounting tab on the phototransistor side. The OPB825B has mounting tabs on both sides.

### Absolute Maximum Ratings ($T_A = 25^{\circ}C$ unless otherwise noted)

Storage and Operating Temperature ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

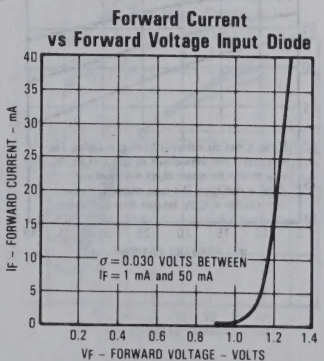
Continuous Forward Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

### Typical Performance Curves



# Types OPB825, OPB825A, OPB825B

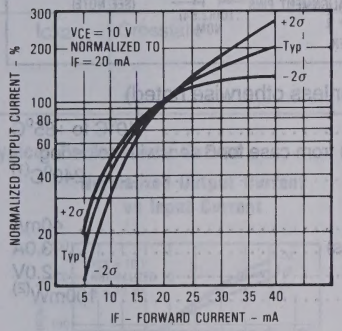
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 1.00mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.40 | V | $I_C$ = 250µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | 500 | | µA | $V_{CE}$ = 10.0V, $I_F$ = 20mA |

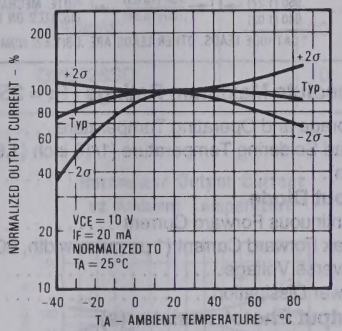


## Typical Performance Curves

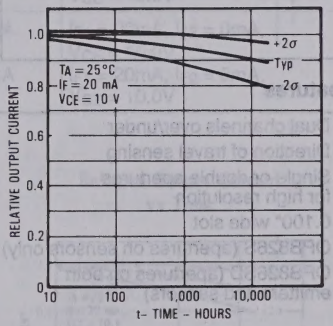
**Normalized Output Current vs Forward Current**



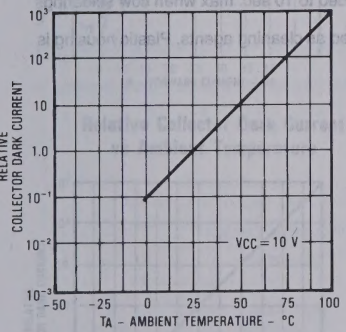

**Normalized Output Current vs Ambient Temperature**



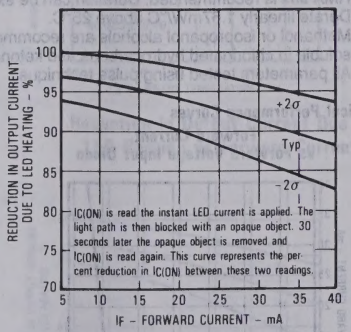

**Relative Output Current vs Time**



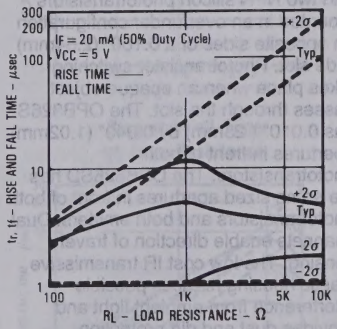

**Relative Collector Dark Current vs Ambient Temperature**




**Reduction in Output Current Due to LED Heating vs Forward Current**


+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the per cent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

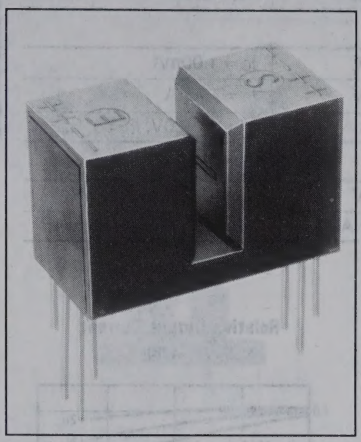
**Rise and Fall Time vs Load Resistance**

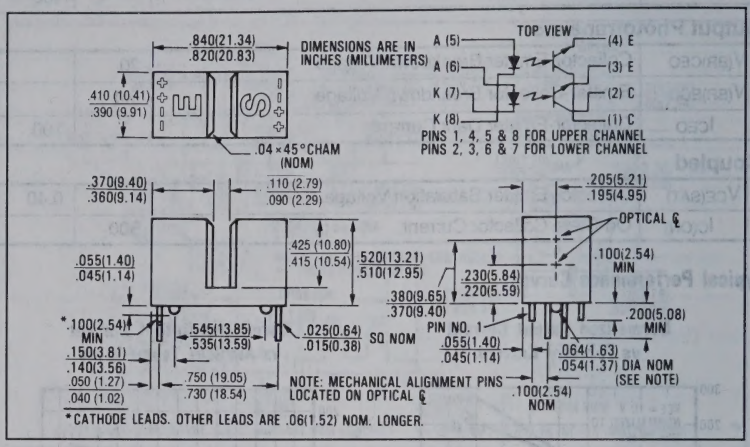



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Dual Channel Slotted Optical Switches
## Types OPB826S, OPB826SD






### Features

- Dual channels over/under
- Direction of travel sensing
- Single or double apertures for high resolution
- 0.100" wide slot
- OPB826S (apertures on sensors only)
- OPB826SD (apertures on both emitters and sensors)

### Description

The OPB826S and OPB826SD each consist of two infrared emitting diodes and two NPN silicon phototransistors mounted in an over/under configuration on opposite sides of a 0.100" (2.54mm) wide slot. Phototransistor switching takes place when an opaque object passes through the slot. The OPB826S has 0.010" (.25mm) by 0.040" (1.02mm) apertures in front of both phototransistors. The OPB826SD has the same sized apertures in front of both phototransistors and both emitters. Dual channels enable direction of travel sensing. The low cost IR transmissive plastic housing reduces possible interference from ambient light and provides dust and dirt protection.

Dual channel (side-by-side) configuration available as OPB822 series.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Continuous Forward Current ..... 40mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

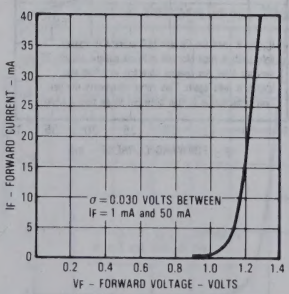
**Output Phototransistor (s)**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

**Typical Performance Curves**

**Forward Current vs Forward Voltage Input Diode**



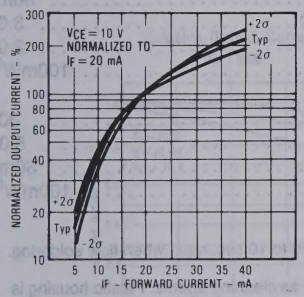
# Types OPB826S, OPB826SD

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

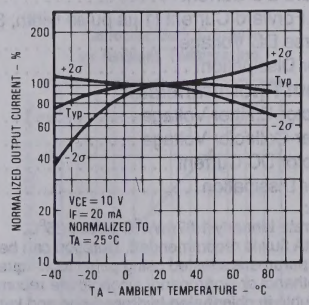
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F = 20mA$ |
| $I_R$ | Reverse Current | | | 100 | μA | $V_R = 2.0V$ |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_C = 1.00mA$ |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E = 100μA$ |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | 100 | nA | $V_{CE} = 10.0V$, $I_F = 0$, $E_e = 0$ |
| **Coupled** | | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | OPB826S | | 0.40 | V | $I_C = 125μA$, $I_F = 20mA$ |
| | | OPB826SD | | 0.40 | V | $I_C = 50μA$, $I_F = 20mA$ |
| $I_{C(ON)}$ | On-State Collector Current | OPB826S | 250 | | μA | $V_{CE} = 10.0V$, $I_F = 20mA$ |
| | | OPB826SD | 100 | | μA | $V_{CE} = 10.0V$, $I_F = 20mA$ |
| $I_{CX1}$ | Crosstalk | OPB826S | | 20 | μA | $I_{F1} = 0mA$, $I_{F2} = 20mA$, $V_{CE} = 10.0V$ |
| | | OPB826SD | | 10 | μA | $I_{F1} = 0mA$, $I_{F2} = 20mA$, $V_{CE} = 10.0V$ |
| $I_{CX2}$ | Crosstalk | OPB826S | | 20 | μA | $I_{F1} = 20mA$, $I_{F2} = 0mA$, $V_{CE} = 10.0V$ |
| | | OPB826SD | | 10 | μA | $I_{F1} = 20mA$, $I_{F2} = 0mA$, $V_{CE} = 10.0V$ |

## Typical Performance Curves

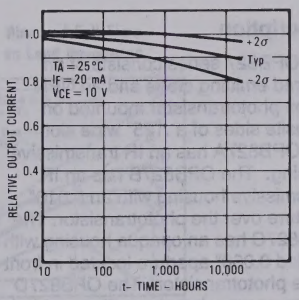
**Normalized Output Current vs Input Current**



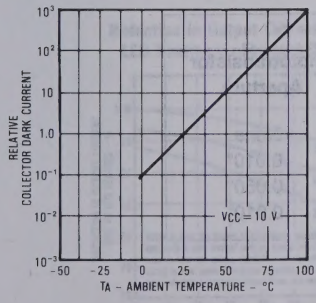

**Normalized Output Current vs Ambient Temperature**



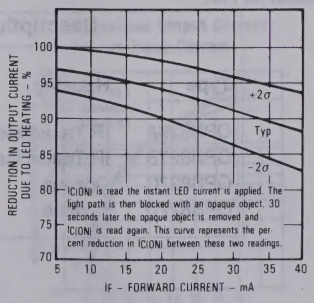

**Relative Output Current vs Time**



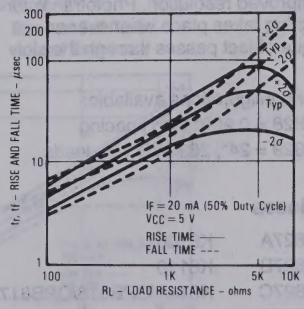

**Relative Collector Dark Current vs Ambient Temperature**




**Reduction in Output Current Due to LED Heating vs Forward Current**


+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the per cent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

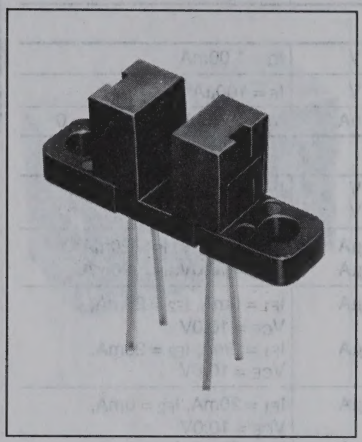
**Rise and Fall Time vs Load Resistance**

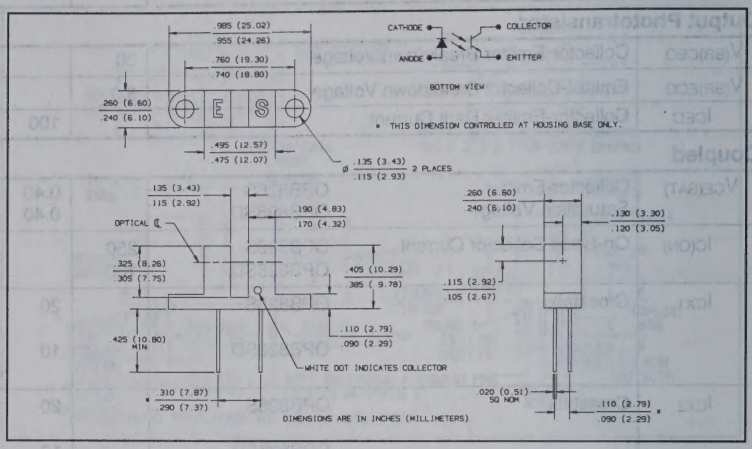



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Slotted Optical Switches
## Types OPB827A, OPB827B, OPB827C, OPB827D






### Features

- Printed circuit board mounting
- 0.125" wide slot
- 0.300" lead spacing
- Inexpensive plastic housing

### Description

The OPB827 series consists of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .125" wide slot. The OPB827A has an IR transmissive housing. The OPB827B has an IR transmissive housing with an 0.010" aperture over the phototransistor. The OPB827C has an opaque housing with a molded 0.060" aperture located in front of the phototransistor. The OPB827D has an opaque housing with a molded 0.010" aperture located over the phototransistor. The apertures provide for improved resolution. Phototransistor switching takes place whenever an opaque object passes through the slot.

Other configurations available:
OPB828 = 0.220" lead spacing
OPB829 = 24", 26 AWG wire leads

### Replaces

| | |
|---|---|
| OPB827A | K8100 |
| OPB827B | K8110 |
| OPB827C | K8141/OPB816/OPB817 |
| OPB827D | K8140 |

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(2)

**Input Diode**

Forward DC Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 100mW(1)

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Collector DC Current ..... 30mA
Power Dissipation ..... 100mW(1)

**Notes:**
(1) Derate Linearly 1.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

**Descriptions**

| Type | Housing | Phototransistor Aperture |
|---|---|---|
| OPB827A | IR Transmissive | None |
| OPB827B | IR Transmissive | 0.010" |
| OPB827C | Opaque | 0.060" |
| OPB827D | Opaque | 0.010" |

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB827A, OPB827B, OPB827C, OPB827D

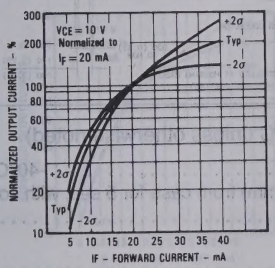
## Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | | 0.6 | V | $I_C$ = 1800µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | 1800 | | µA | $V_{CE}$ = 0.6V, $I_F$ = 20mA |

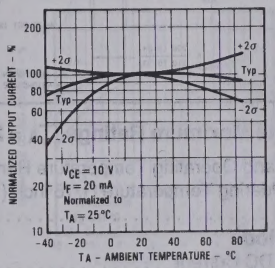


### Typical Performance Curves

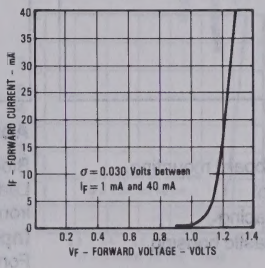
**Normalized Output Current vs Forward Current**



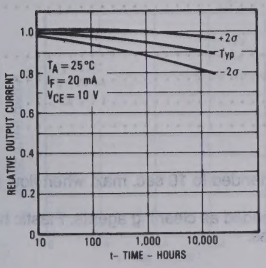

**Normalized Output Current vs Ambient Temperature**



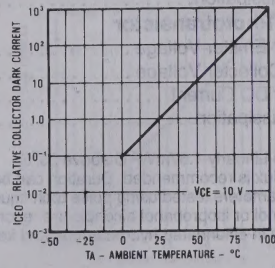

**Forward Current vs Forward Voltage Input Diode**



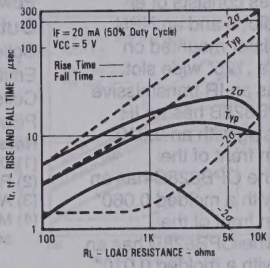

**Relative Output Current vs Time**




**Collector Dark Current vs Ambient Temperature**

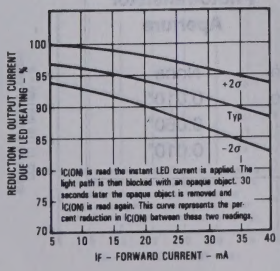



**Rise and Fall Time vs Load Resistance**

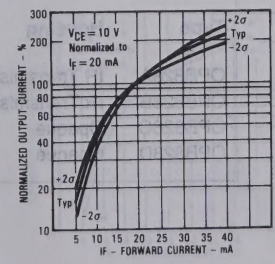



### All Part Numbers Ending in "B and "D"

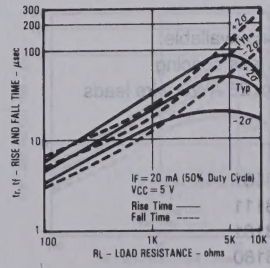
**Reduction in Output Current Due to LED Heating vs Forward Current**


+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

**Normalized Output Current vs Input Current**

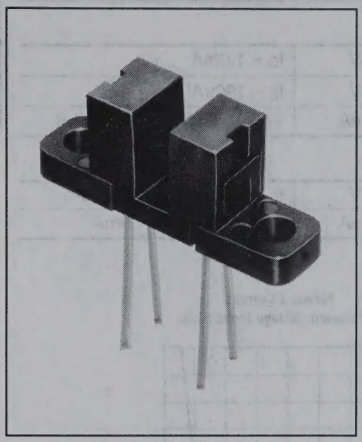


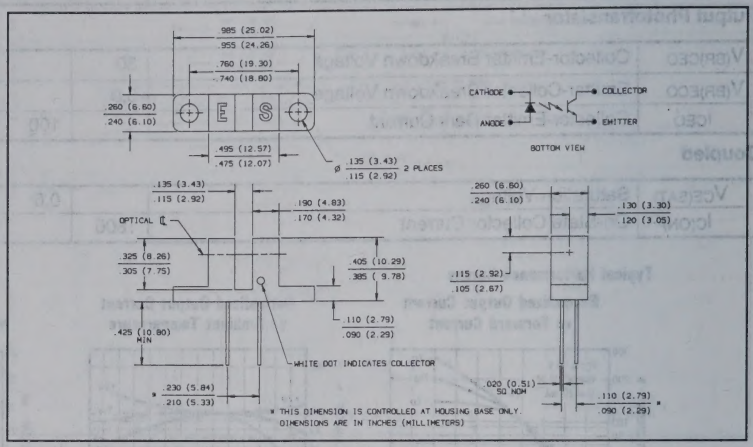

**Rise and Fall Time vs Load Resistance**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Slotted Optical Switches
## Types OPB828A, OPB828B, OPB828C, OPB828D






### Features

- Printed circuit board mounting
- 0.125" wide slot
- 0.220" lead spacing
- Inexpensive plastic housing

### Description

The OPB828 series consists of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .125" wide slot. The OPB828A has an IR transmissive housing. The OPB828B has an IR transmissive housing with an 0.010" aperture located in front of the phototransistor. The OPB828C has an opaque housing with a molded 0.060" aperture located in front of the phototransistor. The OPB828D has an opaque housing with a molded 0.010" aperture located in front of the phototransistor. Phototransistor switching takes place whenever an opaque object passes through the slot.

Other configurations available:
OPB827 = 0.300" lead spacing
OPB829 = 24" min. 26 AWG wire leads

### Replaces

| | |
|---|---|
| OPB828A | K8101 |
| OPB828B | K8111 |
| OPB828C | K8181 |
| OPB828D | K8180 |

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(2)

**Input Diode**

Forward DC Current ..... 50mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 100mW(1)

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Collector DC Current ..... 30mA
Power Dissipation ..... 100mW(1)

**Notes:**
(1) Derate Linearly 1.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

**Descriptions**

| Type | Housing | Phototransistor Aperture |
|---|---|---|
| OPB828A | IR Transmissive | None |
| OPB828B | IR Transmissive | 0.010" |
| OPB828C | Opaque | 0.060" |
| OPB828D | Opaque | 0.010" |

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB828A, OPB828B, OPB828C, OPB828D

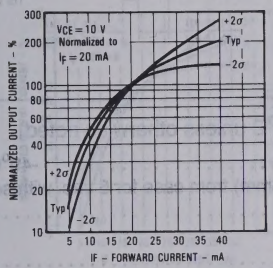
## Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | | 0.6 | V | $I_C$ = 1800µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | 1800 | | µA | $V_{CE}$ = 0.6V, $I_F$ = 20mA |

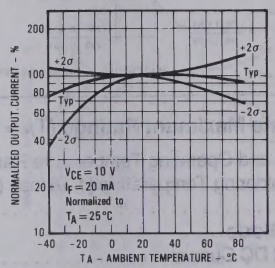


### Typical Performance Curves

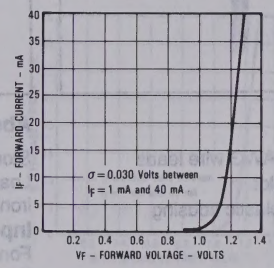
**Normalized Output Current vs Forward Current**



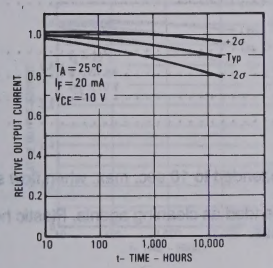

**Normalized Output Current vs Ambient Temperature**



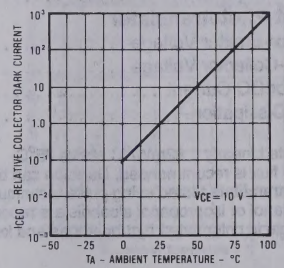

**Forward Current vs Forward Voltage Input Diode**



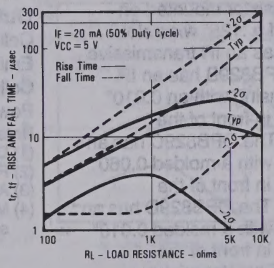

**Relative Output Current vs Time**




**Collector Dark Current vs Ambient Temperature**

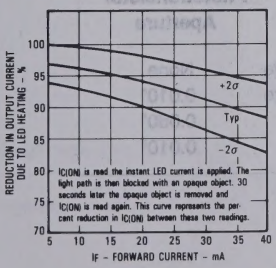



**Rise and Fall Time vs Load Resistance**

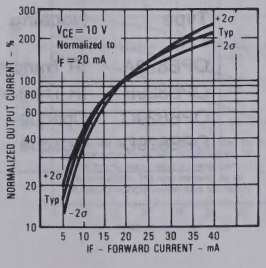



### All Part Numbers Ending in "B and "D"

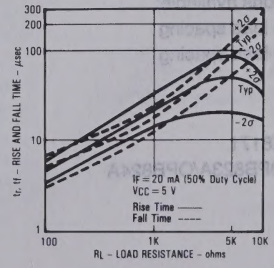
**Reduction in Output Current Due to LED Heating vs Forward Current**


+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

**Normalized Output Current vs Input Current**

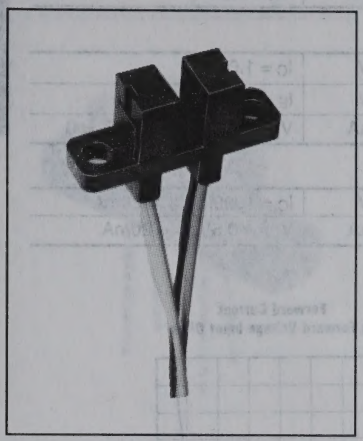


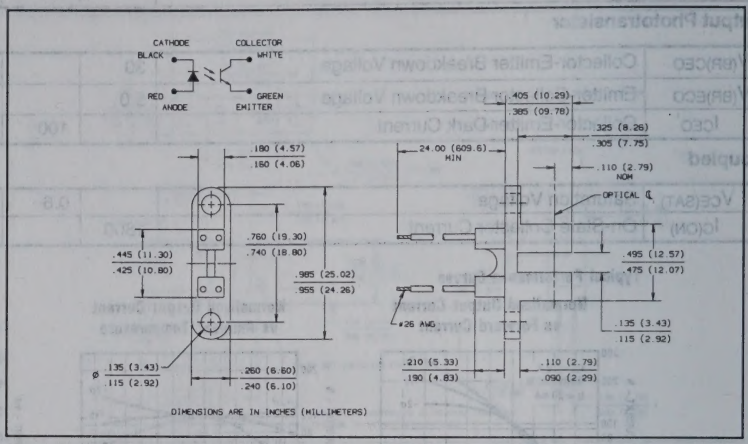

**Rise and Fall Time vs Load Resistance**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Slotted Optical Switches
## Types OPB829A, OPB829B, OPB829C, OPB829D






### Features

- 24" min. #26 AWG wire leads
- 0.125" wide slot
- Inexpensive plastic housing

### Description

The OPB829 series consists of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .125" wide slot. The OPB829A has an IR transmissive housing. The OPB829B has an IR transmissive housing with an 0.010" aperture located in front of the phototransistor. The OPB829C has an opaque housing with a molded 0.060" aperture located in front of the phototransistor. The OPB829D has an opaque housing with a molded 0.010" aperture located in front of the phototransistor. Phototransistor switching takes place whenever an opaque object passes through the slot.

Other configurations available:
OPB827 = 0.300 lead spacing
OPB828 = 0.220 lead spacing

### Replaces

| | |
|---|---|
| OPB829A | K8171 |
| OPB829C | OPB823A/OPB824A |

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +80°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(2)

**Input Diode**

Forward DC Current ..... 50mA
Peak Forward Current (1 µs pulse width , 300 pps) ..... 3.0A
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 100mW(1)

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Collector DC Current ..... 30mA
Power Dissipation ..... 100mW(1)

**Notes:**
(1) Derate Linearly 1.82mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

**Descriptions**

| Type | Housing | Phototransistor Aperture |
|---|---|---|
| OPB829A | IR Transmissive | None |
| OPB829B | IR Transmissive | 0.010" |
| OPB829C | Opaque | 0.060" |
| OPB829D | Opaque | 0.010" |

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB829A, OPB829B, OPB829C, OPB829D

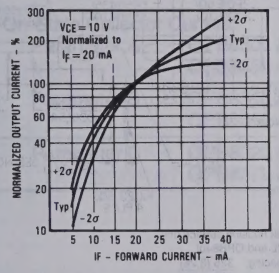
## Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | | 0.6 | V | $I_C$ = 1800µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | 1800 | | µA | $V_{CE}$ = 0.6V, $I_F$ = 20mA |

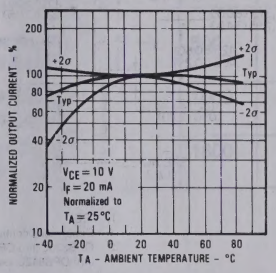


### Typical Performance Curves

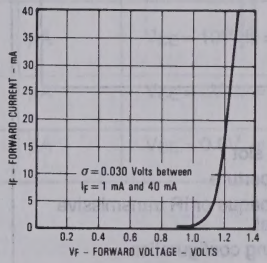
**Normalized Output Current vs Forward Current**



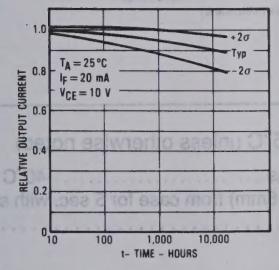

**Normalized Output Current vs Ambient Temperature**



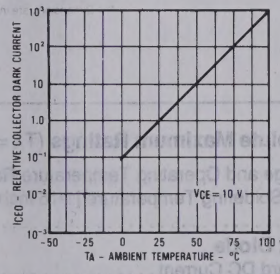

**Forward Current vs Forward Voltage Input Diode**



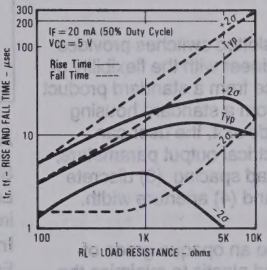

**Relative Output Current vs Time**



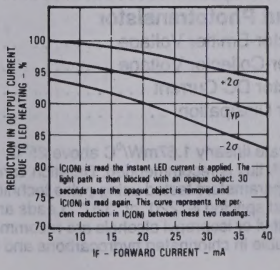

**Collector Dark Current vs Ambient Temperature**




**Rise and Fall Time vs Load Resistance**



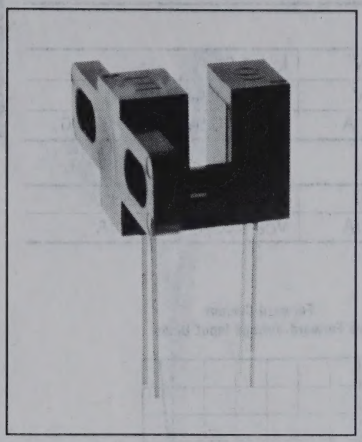

**Reduction in Output Current Due to LED Heating vs Forward Current**

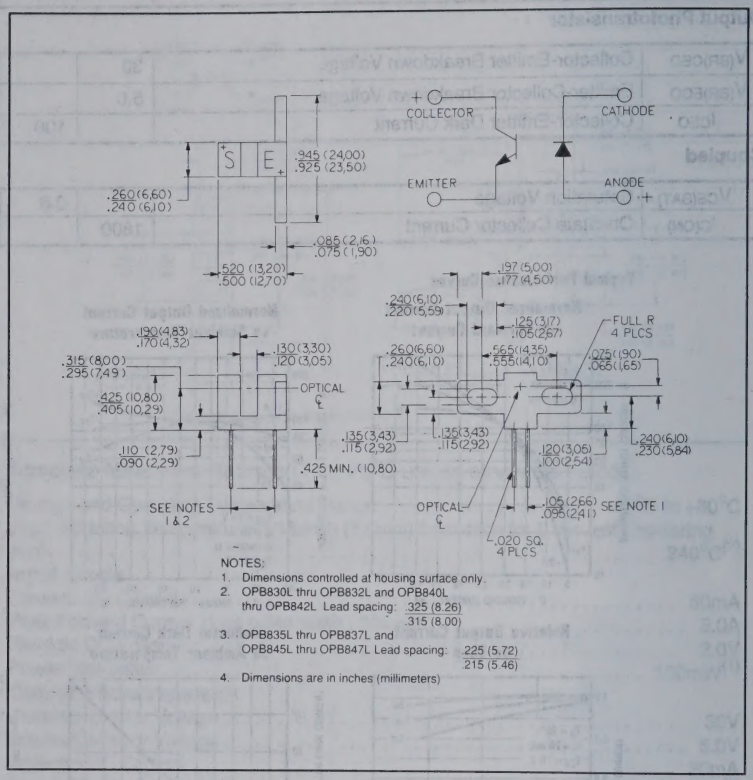

+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Slotted Optical Switches
## Types OPB830L, OPB840L Series






NOTES:
1. Dimensions controlled at housing surface only.
2. OPB830L thru OPB832L and OPB840L thru OPB842L Lead spacing: .325 (8.26) / .315 (8.00)
3. OPB835L thru OPB837L and OPB845L thru OPB847L Lead spacing: .225 (5.72) / .215 (5.46)
4. Dimensions are in inches (millimeters)

### Features

- 0.125" wide slot
- Choice of aperture
- Choice of opaque or IR transmissive shell material
- Side mounting configuration
- Choice of lead spacing

### Description

This series of slotted switches provides the design engineer with the flexibility of a custom device from a standard product line. Building from a standard housing with a .125" wide slot, the user can specify (1) electrical output parameters, (2) choice of lead spacing, (3) discrete shell material and (4) aperture width.

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed only on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic with aperture openings for maximum protection against ambient light.

### Replaces

KT830/KT840 Series

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +85°C(1) |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 100mW(1) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 30mA |
| Power Dissipation | 100mW(1) |

**Notes:**
(1) Derate linearly 1.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Lead spacing is .220" or .320". Leads are 0.20" sq and .425" long (min).
(5) Methyl or isopropyl alcohols are recommended cleaning agents. Plastic housing may be soluble in chlorinated hydrocarbons and ketones.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB830L, OPB840L Series

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | 100 | nA | $V_{CE}$ = 10V |
| **Coupled** | | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage: | | | | | |
| | Parameter A | OPB830L / OPB840L<br>OPB835L / OPB845L | | 0.4 | V | $I_C$ = 400µA, $I_F$ = 20mA |
| | Parameter B | OPB831L / OPB841L<br>OPB836L / OPB846L | | 0.4 | V | $I_C$ = 800µA, $I_F$ = 10mA |
| | Parameter C | OPB832L / OPB842L<br>OPB837L / OPB847L | | 0.6 | V | $I_C$ = 1800µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current: | | | | | |
| | Parameter A | OPB830L / OPB840L<br>OPB835L / OPB845L | 500 | | µA | $V_{CE}$ = 10V, $I_F$ = 20mA |
| | Parameter B | OPB831L / OPB841L<br>OPB836L / OPB846L | 1000 | | µA | $V_{CE}$ = 5V, $I_F$ = 10mA |
| | Parameter C | OPB832L / OPB842L<br>OPB837L / OPB847L | 1800 | | µA | $V_{CE}$ = 0.6V, $I_F$ = 20mA |



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Types OPB830L, OPB840L Series

## PART NUMBER GUIDE

OPB 8 X X X X X

Optek Assembly

Phototransistor Output Family

Discrete Shell Material Designation

3 - Side Mount IR Transmissive Plastic Discrete Shell

4 - Side Mount Opaque Plastic Discrete Shell

Aperture Width In Front of Sensor
5 = 0.050" 1 = 0.010"

Aperture Width In Front of Emitter
5 = 0.050" 1= 0.010"*

Mounting Configurations

L - Solder Leads Termination
W - Wire Termination

Electrical Specification Variations

0 - Electrical Parameter A, 0.320" Lead Spacing

1 - Electrical Parameter B, 0.320" Lead Spacing

2 - Electrical Parameter C, 0.320" Lead Spacing

5 - Electrical Parameter A, 0.220" Lead Spacing

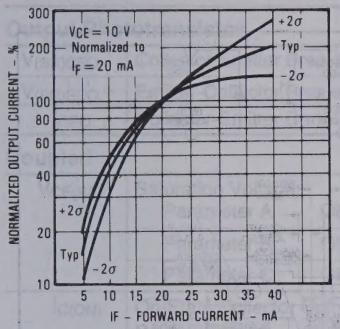
6 - Electrical Parameter B, 0.220" Lead Spacing

7 - Electrical Parameter C, 0.220" Lead Spacing

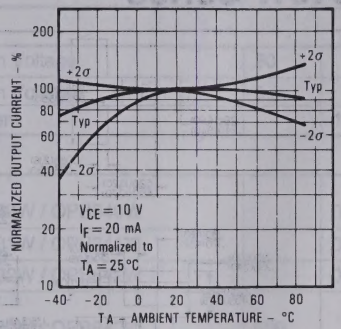
*Assemblies with dual 0.010" apertures are currently available with electrical parameter "A" only.

## Typical Performance Curves

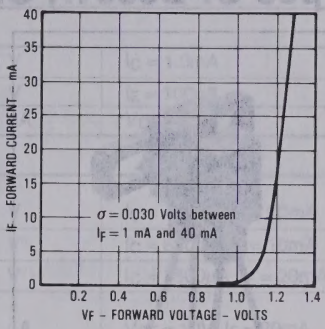
### Normalized Output Current vs Forward Current



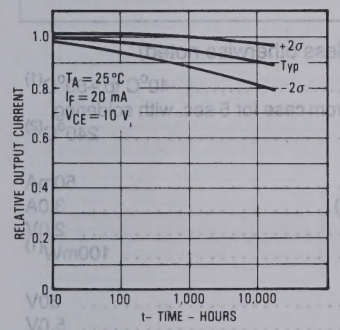

### Normalized Output Current vs Ambient Temperature



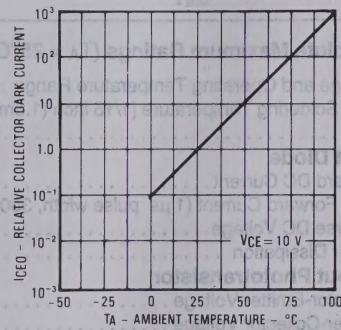

### Forward Current vs Forward Voltage Input Diode



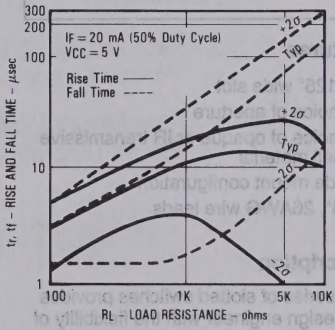

### Relative Output Current vs Time




### Collector Dark Current vs Ambient Temperature

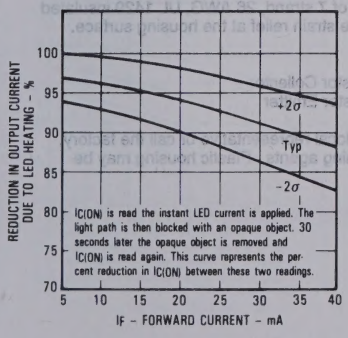



### Rise and Fall Time vs Load Resistance

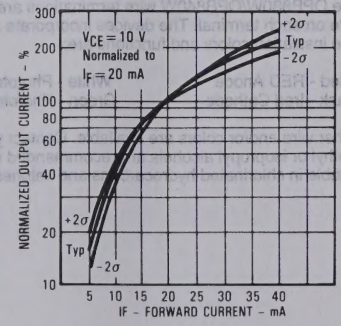



## All Part Numbers Ending in "1"

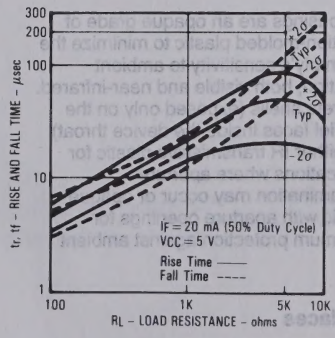
### Reduction in Output Current Due to LED Heating vs Forward Current


IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
+2σ
Typ
-2σ
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

### Normalized Output Current vs Input Current

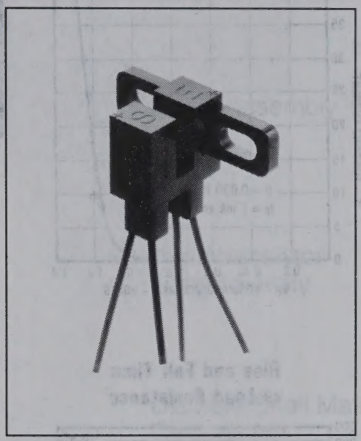


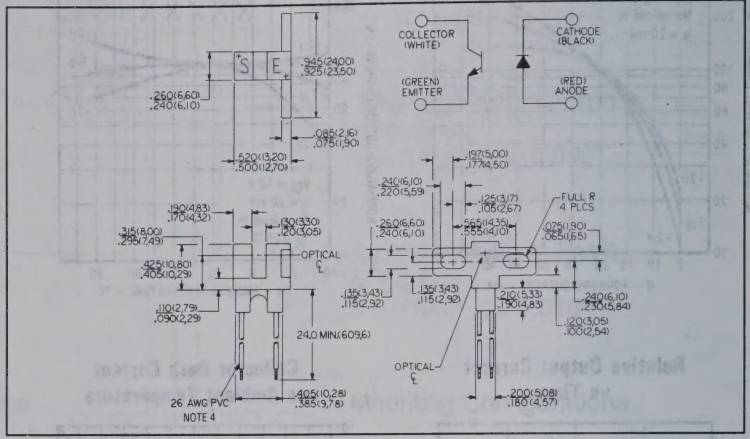

### Rise and Fall Time vs Load Resistance




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Slotted Optical Switches
## Types OPB830W, OPB840W Series






### Features

- 0.125" wide slot
- Choice of aperture
- Choice of opaque or IR transmissive shell material
- Side mount configuration
- 24", 26AWG wire leads

### Description

This series of slotted switches provides the design engineer with the flexibility of a custom device from a standard product line. Building from a standard housing with a .125" wide slot, the user can specify (1) Electrical output parameters, (2) discrete shell material and (3) aperture width.

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed only on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic with aperture openings for maximum protection against ambient light.

### Replaces

KT830W/KT840W Series

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +80°C(1) |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Input Diode**

| | |
|---|---|
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 100mW(1) |

**Output Phototransistor**

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 30mA |
| Power Dissipation | 100mW(1) |

**Notes:**

(1) Derate linearly 1.82mW/°C above 25°C. (Maximum storage and operating temperature, limited by the temperature rating of the lead wires)
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) The OPB830W/OPB840W wire terminations are 24" of 7 strand, 26 AWG, UL 1429 insulated wire on each terminal. The devices incorporate a wire strain relief at the housing surface. The insulation colors and functions are:

| | |
|---|---|
| Red - RED Anode | White - Phototransistor Collector |
| Black - Ired Cathode | Green - Phototransistor Emitter |

Other wire and/or colors are available. Contact your local representative or call the factory.
(5) Methyl or isopropyl alcohols are recommended cleaning agents. Plastic housing may be soluble in chlorinated hydrocarbons and ketones.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB830W, OPB840W Series

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

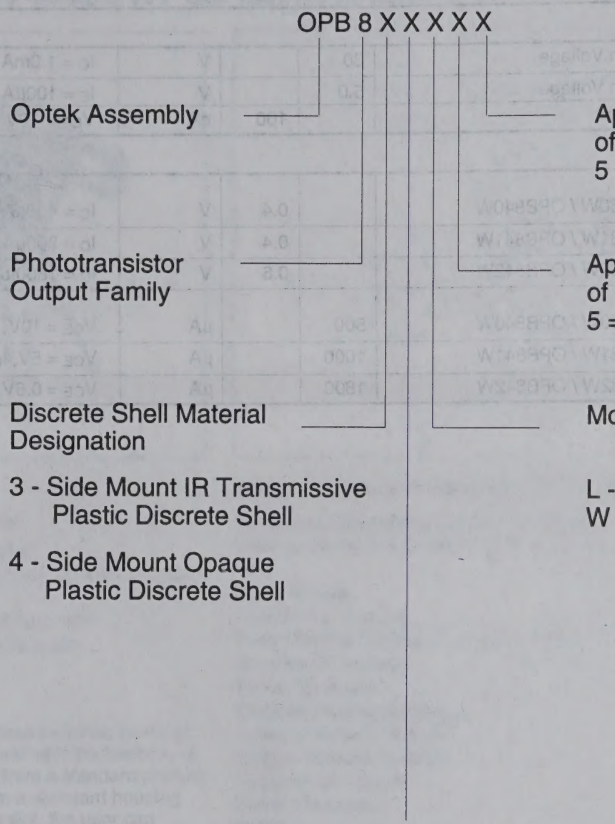
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10V |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage: | | | | |
| | Parameter A OPB830W / OPB840W | | 0.4 | V | $I_C$ = 400µA, $I_F$ = 20mA |
| | Parameter B OPB831W / OPB841W | | 0.4 | V | $I_C$ = 800µA, $I_F$ = 10mA |
| | Parameter C OPB832W / OPB842W | | 0.6 | V | $I_C$ = 1800µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current: | | | | |
| | Parameter A OPB830W / OPB840W | 500 | | µA | $V_{CE}$ = 10V, $I_F$ = 20mA |
| | Parameter B OPB831W / OPB841W | 1000 | | µA | $V_{CE}$ = 5V, $I_F$ = 10mA |
| | Parameter C OPB832W / OPB842W | 1800 | | µA | $V_{CE}$ = 0.6V, $I_F$ = 20mA |



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

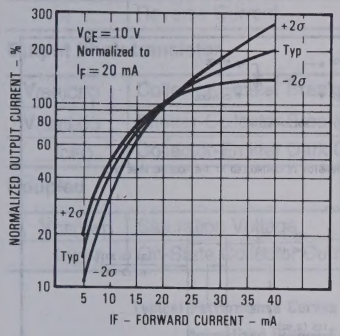
# PART NUMBER GUIDE


OPB 8 X X X X X
Optek Assembly
Phototransistor Output Family
Discrete Shell Material Designation
3 - Side Mount IR Transmissive Plastic Discrete Shell
4 - Side Mount Opaque Plastic Discrete Shell
Aperture Width In Front of Sensor
5 = 0.050" 1 = 0.010"
Aperture Width In Front of Emitter
5 = 0.050" 1= 0.010"*
Mounting Configurations
L - Solder Leads Termination
W - Wire Termination
Electrical Specification Variations
0 - Electrical Parameter A
1 - Electrical Parameter B
2 - Electrical Parameter C

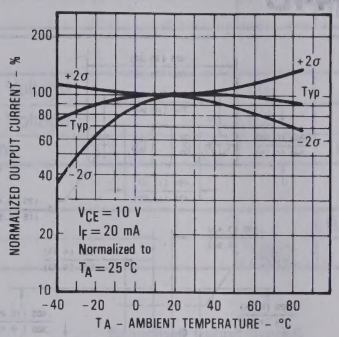
*Assemblies with dual 0.010" apertures are currently available with electrical parameter "A" only.

## Typical Performance Curves

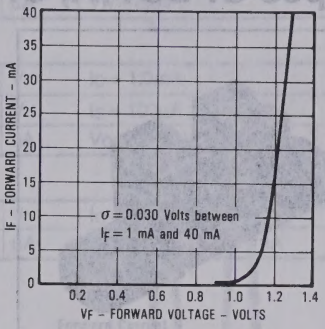
### Normalized Output Current vs Forward Current



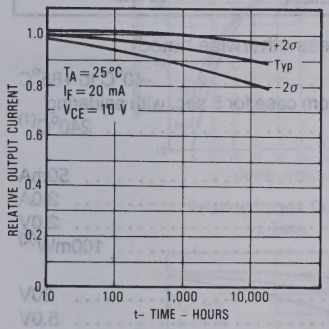

### Normalized Output Current vs Ambient Temperature



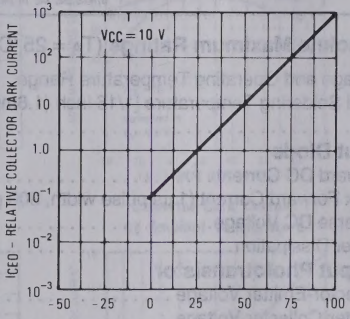

### Forward Current vs Forward Voltage Input Diode



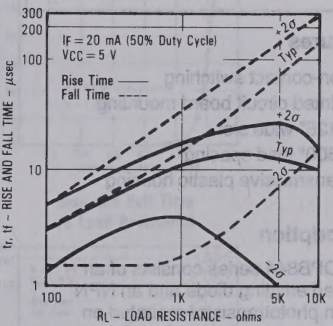

### Relative Output Current vs Time




### Collector Dark Current vs Ambient Temperature

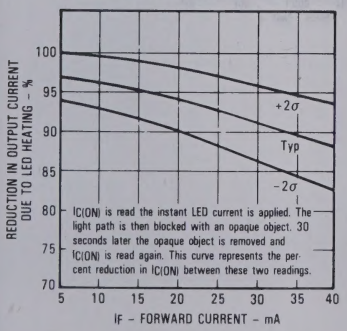



### Rise and Fall Time vs Load Resistance

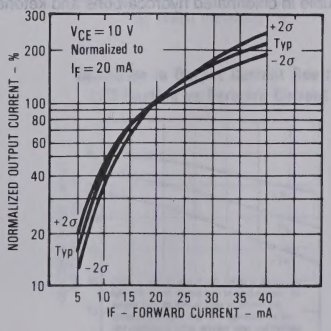



## All Part Numbers Ending in "1"

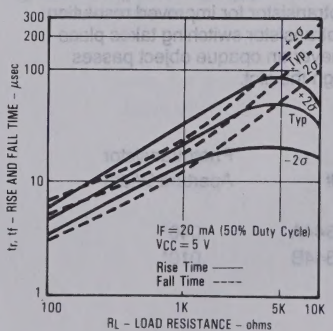
### Reduction in Output Current Due to LED Heating vs Forward Current


REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING – %
IF – FORWARD CURRENT – mA
+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.

### Normalized Output Current vs Input Current

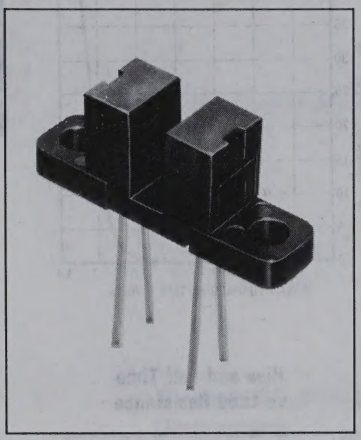


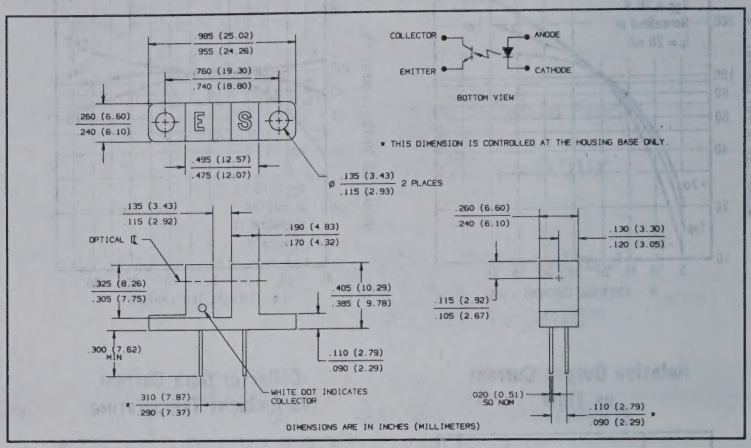

### Rise and Fall Time vs Load Resistance




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Slotted Optical Switches
## Types OPB844A, OPB844B






### Features

- Non-contact switching
- Printed circuit board mounting
- 0.125" wide slot
- 0.300" lead spacing
- Transmissive plastic housing

### Description

The OPB844 series consists of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .125" wide slot. The inexpensive plastic housing is transmissive to infrared and provides for environmental protection from dust and contamination. The "A" option is unapertured, while the "B" version offers a .010" wide aperture located over the phototransistor for improved resolution. Phototransistor switching takes place whenever an opaque object passes through the slot.

| OPB# | Phototransistor Aperture Width |
|---|---|
| OPB844A | .040" |
| OPB844B | .010" |

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Input Diode**

| | |
|---|---|
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 100mW(2) |

**Output Phototransistor**

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 30mA |
| Power Dissipation | 100mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB844A, OPB844B

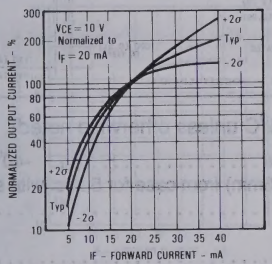
## Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | | 0.6 | V | $I_C$ = 1800µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | 1800 | | µA | $V_{CE}$ = 0.6V, $I_F$ = 20mA |

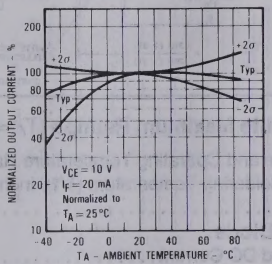


### Typical Performance Curves

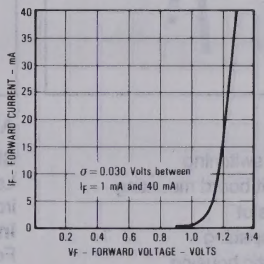
**Normalized Output Current vs Forward Current**



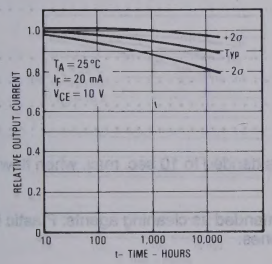

**Normalized Output Current vs Ambient Temperature**



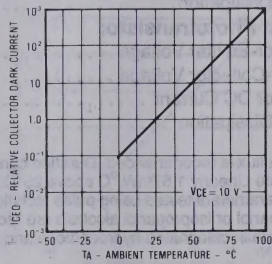

**Forward Current vs Forward Voltage Input Diode**



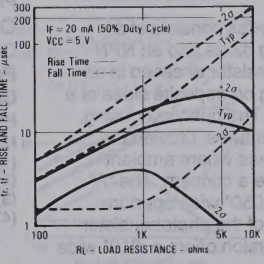

**Relative Output Current vs Time**



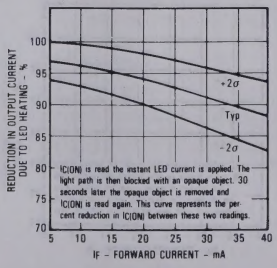

**Collector Dark Current vs Ambient Temperature**




**Rise and Fall Time vs Load Resistance**



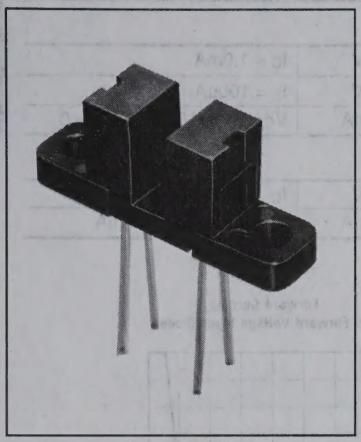

**Reduction in Output Current Due to LED Heating vs Forward Current**

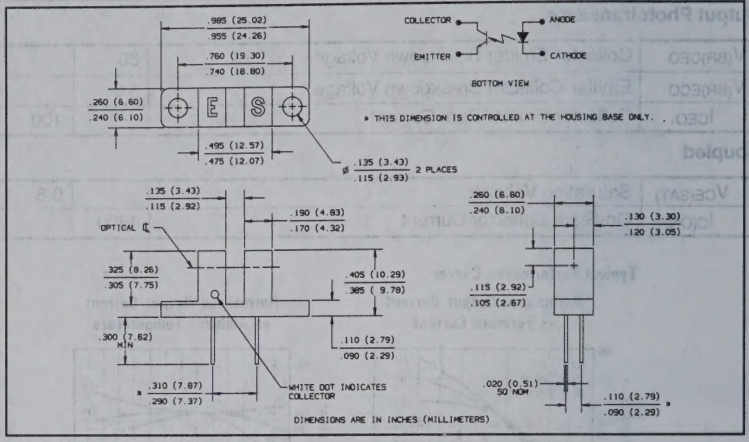

+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the per cent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Slotted Optical Switches
## Types OPB845A, OPB845B






### Features

- Non-contact switching
- Printed circuit board mounting
- 0.125" wide slot
- 0.300" lead spacing
- Opaque plastic housing

### Description

The OPB845 series consists of an infrared emitting diode and an NPN silicon phototransistor encased in an opaque housing on opposite sides of a .125" wide slot. The opaque housing, with molded apertures, provides protection in areas where ambient radiation may be a concern. The "A" option offers a .050" wide aperture molded in front of the phototransistor while the "B" version offers a .010" wide aperture.

| OPB# | Phototransistor Aperture Width |
|---|---|
| OPB845A | 0.050" |
| OPB845B | 0.010" |

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Forward DC Current ..... 50mA
Peak Forward Current (1µs pulse width, 300 pps) ..... 3.0A
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Collector DC Current ..... 30mA
Power Dissipation ..... 100mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

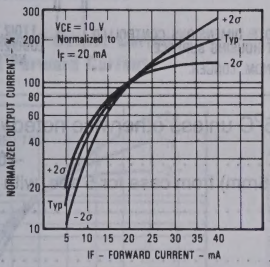
# Types OPB845A, OPB845B

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

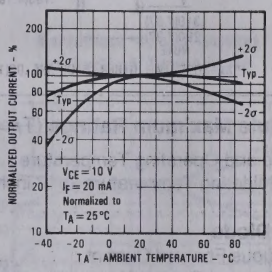
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | | 0.6 | V | $I_C$ = 1800µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | 1800 | | µA | $V_{CE}$ = 0.6V, $I_F$ = 20mA |

**Typical Performance Curves**

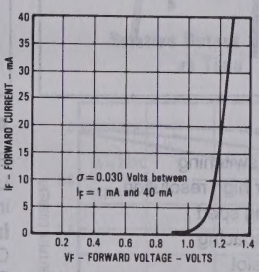
**Normalized Output Current vs Forward Current**



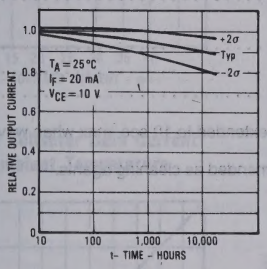

**Normalized Output Current vs Ambient Temperature**



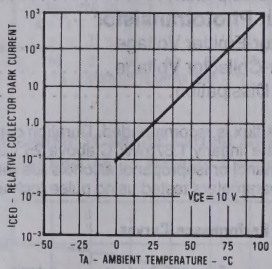

**Forward Current vs Forward Voltage Input Diode**



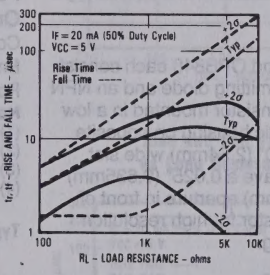

**Relative Output Current vs Time**



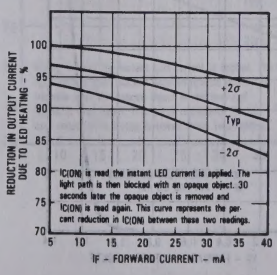

**Collector Dark Current vs Ambient Temperature**




**Rise and Fall Time vs Load Resistance**



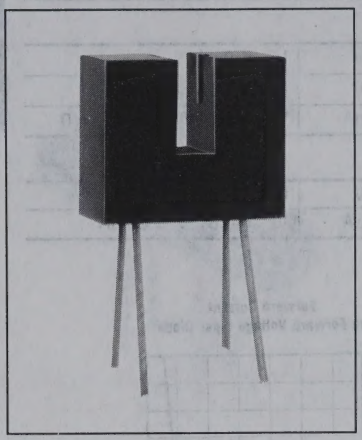

**Reduction in Output Current Due to LED Heating vs Forward Current**

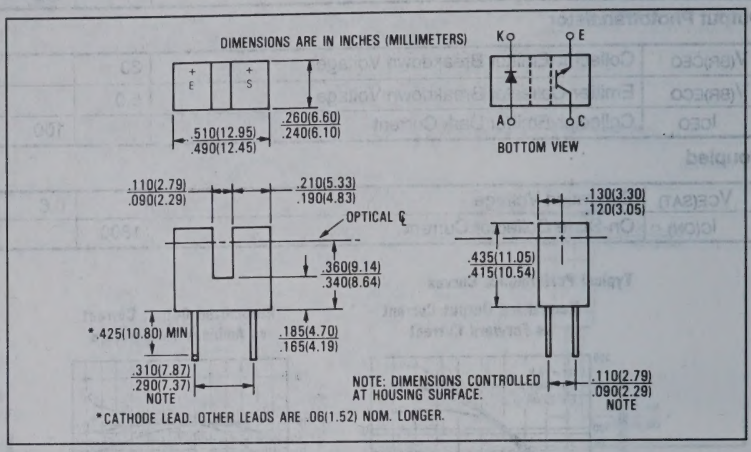

+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Slotted Optical Switches
## Types OPB847, OPB848






### Features

- Non-contact switching
- Apertured for high resolution
- Fast switching sped
- 0.300" lead spacing
- 0.100" wide slot
- TX-TXV process available (see Hi-Rel section)

### Description

The OPB847 and OPB848 each consist of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost black plastic housing on opposite sides of a 0.100" (2.54mm) wide slot. Both devices have a 0.025" (0.635mm) by 0.06" (1.52mm) aperture in front of the phototransistor for high resolution position sensing.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Input Diode**

| | |
|---|---|
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse Voltage | 2.0V |
| Power Dissipation | 100mW(2) |

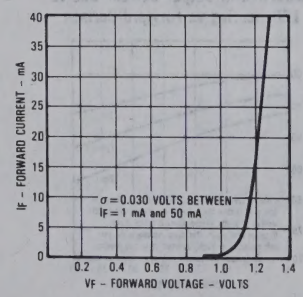
**Output Phototransistor**

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 100mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when wave soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents.
(4) All parameters tested using pulse technique.

**Typical Performance Curves**

**Forward Current vs Forward Voltage Input Diodes**



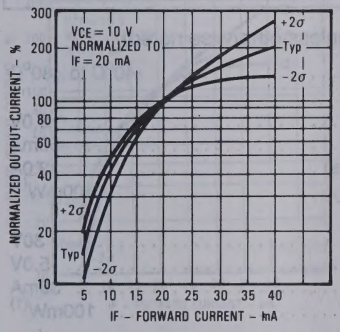
# Types OPB847, OPB848

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

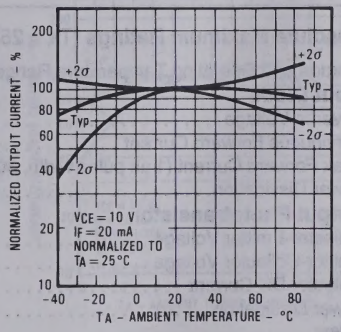
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_C$ = 1.00mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | OPB847<br>OPB848 | | 0.40<br>0.40 | V<br>V | $I_C$ = 2.0mA, $I_F$ = 20mA<br>$I_C$ = 0.50mA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | OPB847<br>OPB848 | 4.0<br>1.0 | | mA<br>mA | $V_{CE}$ = 10.0V, $I_F$ = 20mA<br>$V_{CE}$ = 10.0V, $I_F$ = 20mA |

## Typical Performance Curves

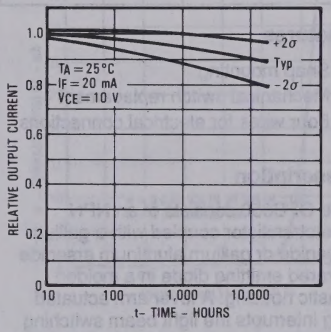
**Normalized Output Current vs Forward Current**



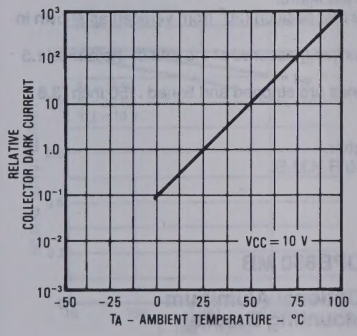

**Normalized Output Current vs Ambient Temperature**



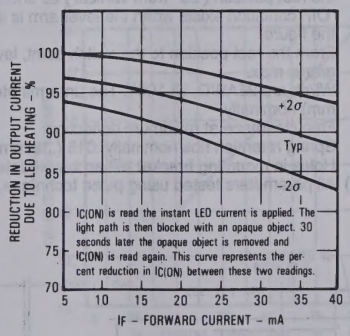

**Relative Output Current vs Time**



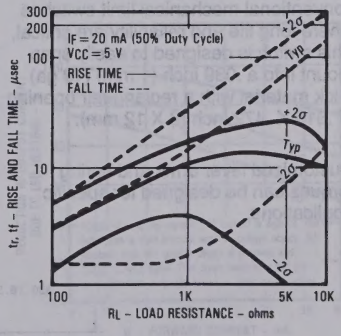

**Relative Collector Dark Current vs Ambient Temperature**




**Reduction in Output Current Due to LED Heating vs Forward Current**


+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

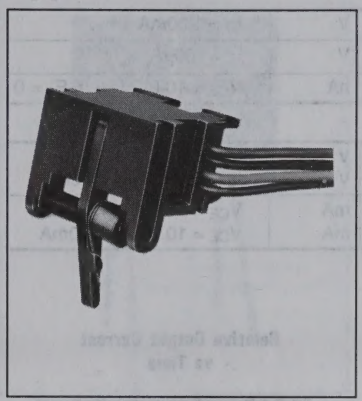
**Rise and Fall Time vs Load Resistance**

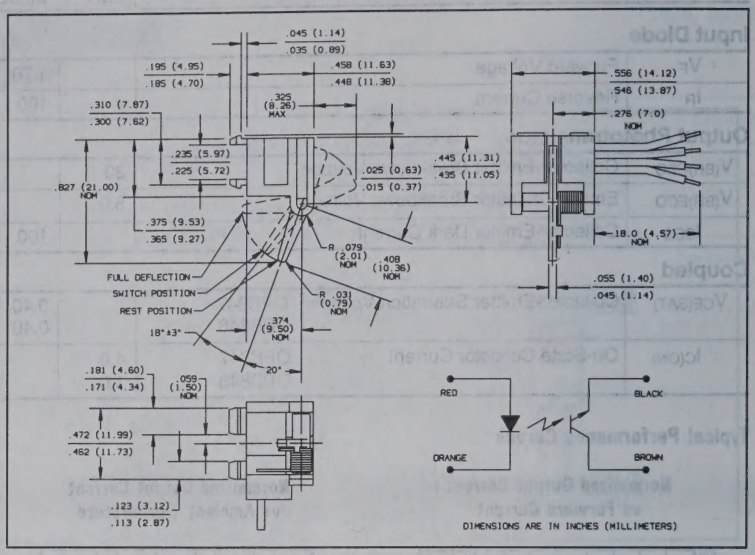



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Optical Flag Switch
## Type OPB850






### Features

- Snap mounting
- Mechanical switch replacement
- Four wires for electrical connections

### Description

The OPB850 consists of an NPN phototransistor coupled with a gallium arsenide or gallium aluminum arsenide infrared emitting diode in a molded plastic housing. A lever arm actuated flag interrupts the light beam switching the transistor output between states that can readily drive logic gates.

The OPB850 is designed to replace conventional mechanical limit switches where long life and reliability are critical. This switch is designed to easily snap mount into a .039 inch (1 mm) (19 ga) thick material with a rectangular opening of .315 X .472 inch (8 X 12 mm).

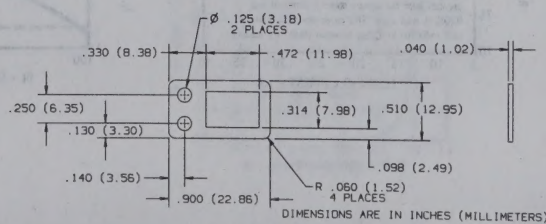
Customized lever arms and spring torques can be designed for specific applications.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +80°C |
| **Input Diode** | |
| Reverse Voltage | 2.0V |
| Continuous Forward Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Power Dissipation | 100mW(1) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 30mA |
| Power Dissipation | 100mW(1) |

**Notes:**

(1) Derate linearly 1.82mW/°C above 25°C.
(2) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(3) "On" condition or switch point exists when the lever arm is deflected clockwise 18° ± 3° from the rest position ( 20° from vertical ) as shown in the figure.
(4) "Off" condition exists when the lever arm is in the rest position (20° from vertical) as shown in the figure.
(5) From the rest position to the switch point, lever torque measured at the end of the arm is 1.5 grams max.
(6) Wires are 26AWG, UL1061. The unterminated ends are stripped and tinned .150 inch (3.81 mm) nominally.
(7) Flag clearance at maximum deflection.
(8) Spring retention ribs nominally .015 (.38 mm) higher.
(9) Holes in mounting bracket will accommodate 4/40 R.H.M.S.
(10) All parameters tested using pulse technique.




**OPB850 MB**

**Optional Aluminum Mounting Bracket**

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Type OPB850

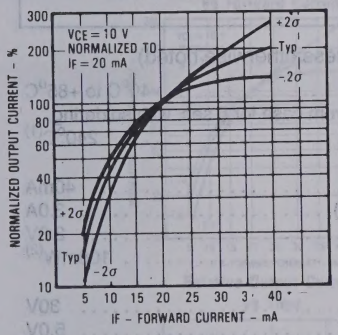
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 100µA, |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA, |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.4 | V | $I_C$ = 500µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | 500 | | µA | $V_{CE}$ = 10V, $I_F$ = 20mA(3)(5) |
| $I_{C(OFF)}$ | Off-State Collector Current | | 10 | µA | $V_{CE}$ = 10V, $I_F$ = 20mA(4) |

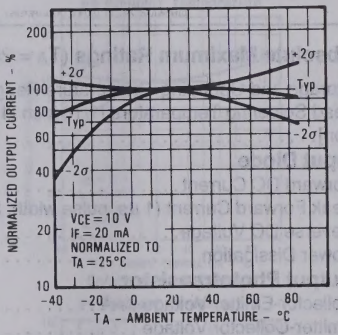


## Typical Performance Curves

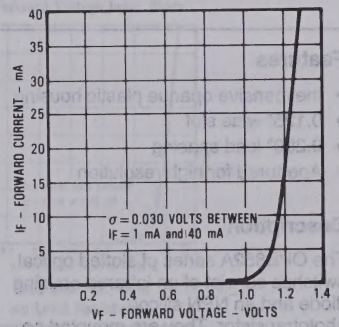
**Normalized Output Current vs. Forward Current**



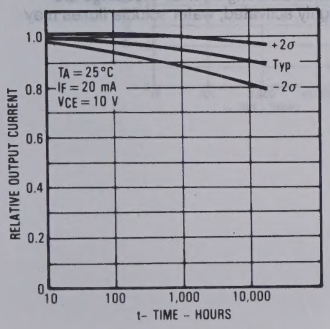

**Normalized Output Current vs. Ambient Temperature**



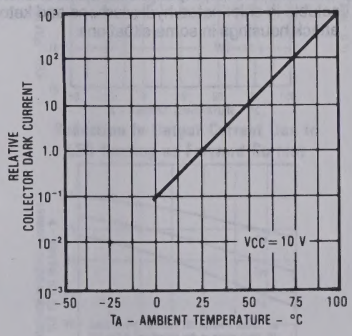

**Forward Current vs. Forward Voltage**



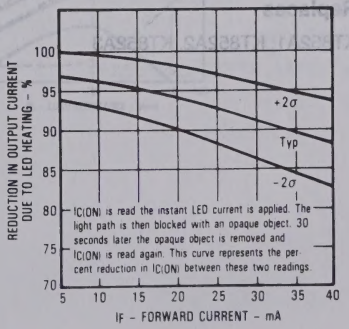

**Relative Output Current vs. Time**




**Relative Collector Dark Current vs. Ambient Temperature**



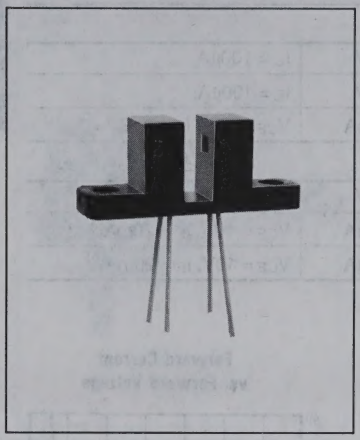

**Reduction in Output Current Due to LED Heating vs. Forward Current**

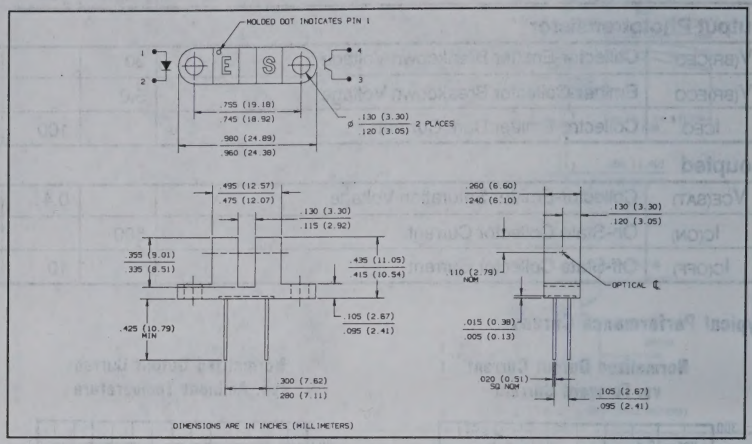

+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the per cent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Slotted Optical Switches
## Types OPB852A1, OPB852A2, OPB852A3






### Features

- Inexpensive opaque plastic housing
- 0.125" wide slot
- 0.290" lead spacing
- Apertured for high resolution

### Description

The OPB852A series of slotted optical switches consist of an infrared emitting diode and an NPN silicon phototransistor. They are mounted on opposite sides of a .125" wide slot. The emitter has a .050" X .050" molded-in aperture while the phototransistor has a .010" X .050" molded-in aperture.

### Replaces

KT852A1, KT852A2, KT852A3

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Forward DC Current ..... 40mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

**Notes:**

(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol and isopropanol alcohols are recommended as cleaning agents. Housings are soluble in chlorinated hydrocarbons and ketones. Highly activated, water soluble fluxes may attack housings in some situations.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

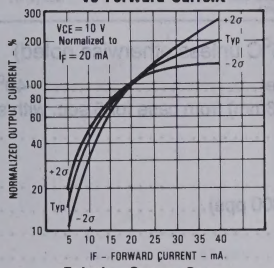
# Types OPB852A1, OPB852A2, OPB852A3

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

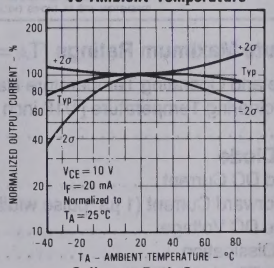
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | 100 | nA | $V_{CE}$ = 10V |
| **Coupled** | | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | OPB852A1 | | 0.40 | V | $I_C$ = 500µA, $I_F$ = 20mA |
| | | OPB852A2 | | 0.40 | V | $I_C$ = 500µA, $I_F$ = 20mA |
| | | OPB852A3 | | 0.40 | V | $I_C$ = 1.8mA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | OPB852A1 | 1.0 | | mA | $V_{CE}$ = 5.0V, $I_F$ = 20mA |
| | | OPB852A2 | 2.0 | | mA | $V_{CE}$ = 5.0V, $I_F$ = 20mA |
| | | OPB852A3 | 4.0 | | mA | $V_{CE}$ = 5.0V, $I_F$ = 20mA |

**Typical Performance Curves**

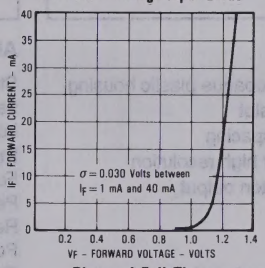
**Normalized Output Current vs Forward Current**



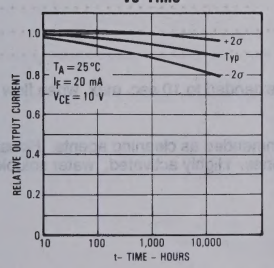

**Normalized Output Current vs Ambient Temperature**



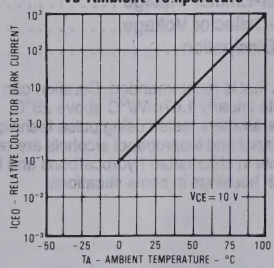

**Forward Current vs Forward Voltage Input Diode**



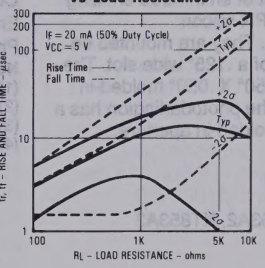

**Relative Output Current vs Time**



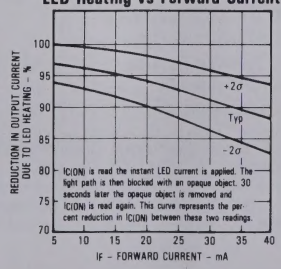

**Collector Dark Current vs Ambient Temperature**




**Rise and Fall Time vs Load Resistance**



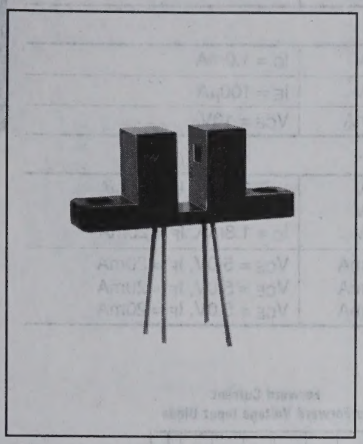

**Reduction in Output Current Due to LED Heating vs Forward Current**

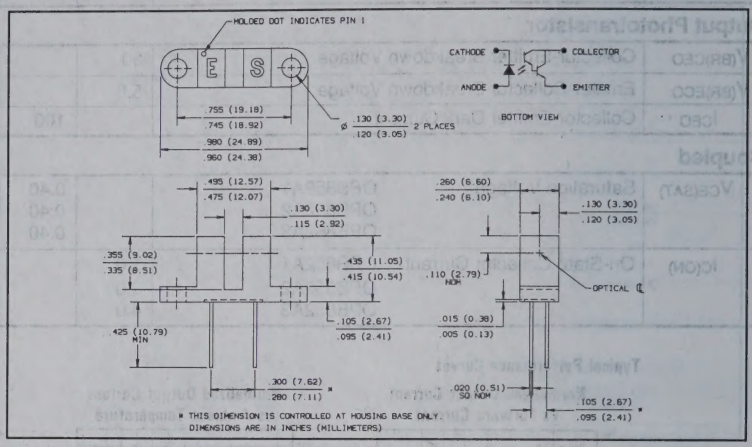

+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Slotted Optical Switches
## Types OPB853A1, OPB853A2, OPB853A3






### Features

- Inexpensive opaque plastic housing
- 0.125" wide slot
- 0.290" lead spacing
- Apertured for high resolution
- Photodarlington output

### Description

The OPB853A series of slotted optical switches consist of an infrared emitting diode and an NPN silicon photodarlington. They are mounted on opposite sides of a .125" wide slot. The emitter has a .050" X .050" molded-in aperture while the photodarlington has a .010" X .050" molded-in aperture.

### Replaces

KT853A1, KT853A2, KT853A3

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Input Diode**

Forward DC Current ..... 40mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

**Output Photodarlington**

Collector-Emitter Voltage ..... 15V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

**Notes:**

(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol and isopropanol alcohols are recommended as cleaning agents. Housings are soluble in chlorinated hydrocarbons and ketones. Highly activated, water soluble fluxes may attack housings in some situations.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB853A1, OPB853A2, OPB853A3

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

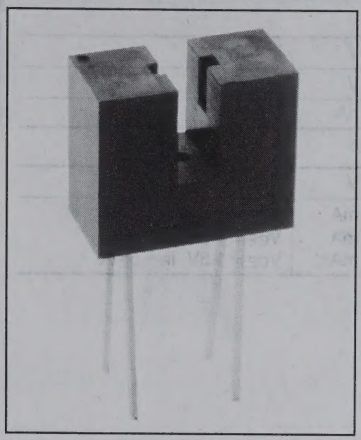
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Photodarlington** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 15 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | 100 | nA | $V_{CE}$ = 10V |
| **Coupled** | | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | | | 1.0 | V | $I_C$ = 1.8mA, $I_F$ = 10mA |
| $I_{C(ON)}$ | On-State Collector Current | OPB853A1 | 2.5 | | mA | $V_{CE}$ = 1.5V, $I_F$ = 5mA |
| | | OPB853A2 | 5.0 | | mA | $V_{CE}$ = 1.5V, $I_F$ = 5mA |
| | | OPB853A3 | 10.0 | | mA | $V_{CE}$ = 1.5V, $I_F$ = 5mA |

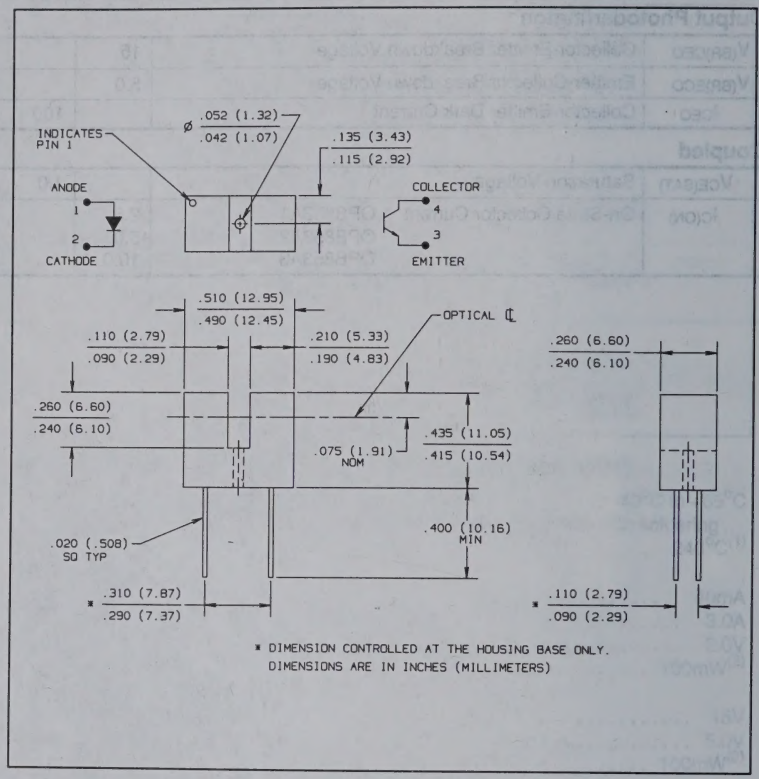


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Slotted Optical Switches
## Types OPB854A1, OPB854B1






### Features

- Non-contact switching
- Printed circuit board mounting
- 0.100" wide slot
- 0.300" lead spacing
- Opaque plastic housing

### Description

The OPB854A1 and OPB854B1 each consist of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .100" wide slot in an inexpensive plastic housing. Switching of the phototransistor occurs whenever an opaque object passes through the slot. Also available with one mounting tab as OPB854A2 and OPB854B2, or with two mounting tabs as OPB854A3 and OPB854B3.

### Replaces

KT850A, KT851A

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 100mW(2) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 30mA |
| Power Dissipation | 100mW |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB854A1, OPB854B1

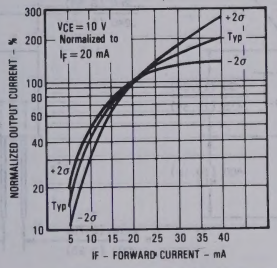
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | 10 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | 100 | nA | $V_{CE}$ = 10V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | OPB854A1 | | 0.6 | V | $I_C$ = 2.0mA, $I_F$ = 16mA |
| | | OPB854B1 | | 0.4 | V | $I_C$ = 250µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | OPB854A1 | 3.0 | | mA | $V_{CE}$ = 1.0V, $I_F$ = 16mA |
| | | OPB854B1 | 1.0 | | mA | $V_{CE}$ = 10.0V, $I_F$ = 20mA |

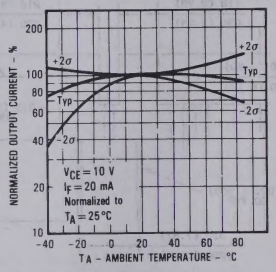


**Typical Performance Curves**

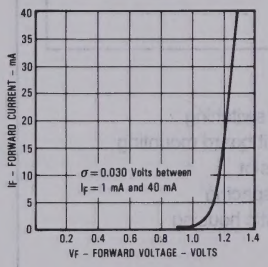
**Normalized Output Current vs Forward Current**



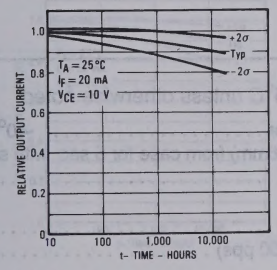

**Normalized Output Current vs Ambient Temperature**



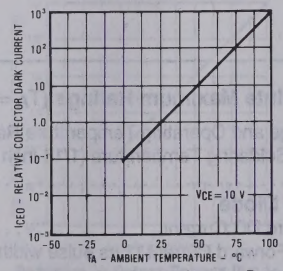

**Forward Current vs Forward Voltage Input Diode**



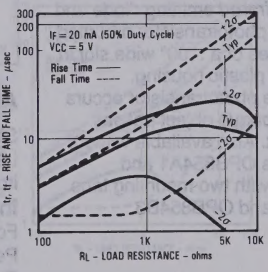

**Relative Output Current vs Time**



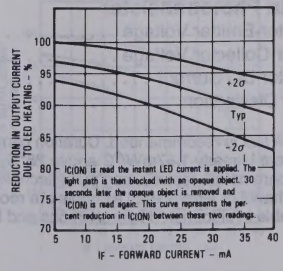

**Collector Dark Current vs Ambient Temperature**




**Rise and Fall Time vs Load Resistance**



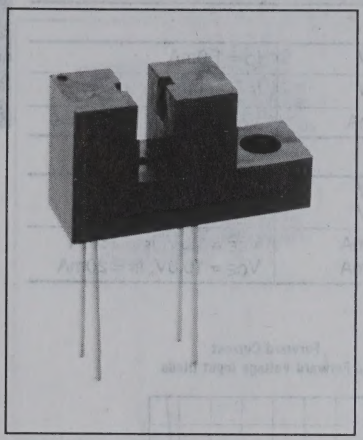

**Reduction in Output Current Due to LED Heating vs Forward Current**

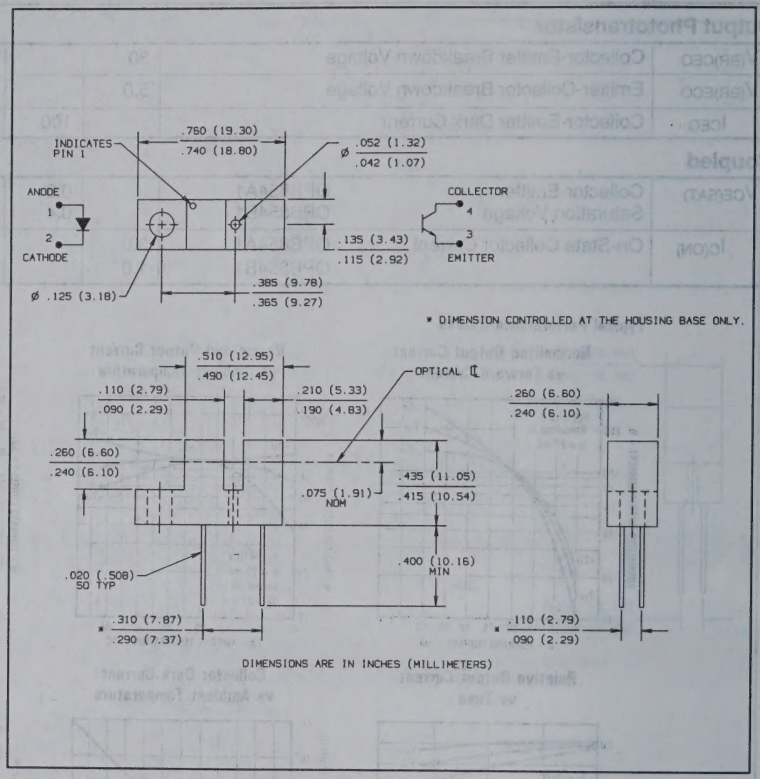

+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Slotted Optical Switches
## Types OPB854A2, OPB854B2






### Features

- Non-contact switching
- Printed circuit board mounting
- 0.100" wide slot
- 0.300" lead spacing
- Opaque plastic housing

### Description

The OPB854A2 and OPB854B2 each consist of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .100" wide slot in an inexpensive plastic housing. Switching of the phototransistor occurs whenever an opaque object passes through the slot. Also available without mounting tab as OPB854A1 and OPB854B1, or with two mounting tabs as OPB854A3 and OPB854B3.

### Replaces

KT850B, KT851B

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Input Diode**

| | |
|---|---|
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 100mW(2) |

**Output Phototransistor**

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 30mA |
| Power Dissipation | 100mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB854A2, OPB854B2

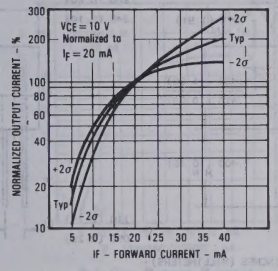
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | 10 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | 100 | nA | $V_{CE}$ = 10V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | OPB854A2 | | 0.6 | V | $I_C$ = 2.0mA, $I_F$ = 16mA |
| | | OPB854B2 | | 0.4 | V | $I_C$ = 250µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | OPB854A2 | 3.0 | | mA | $V_{CE}$ = 1.0V, $I_F$ = 16mA |
| | | OPB854B2 | 1.0 | | mA | $V_{CE}$ = 10.0V, $I_F$ = 20mA |

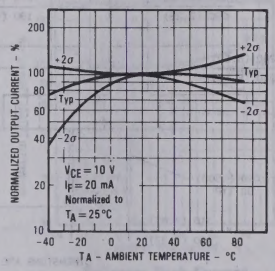
SLOTTED OPTICAL SWITCHES

**Typical Performance Curves**

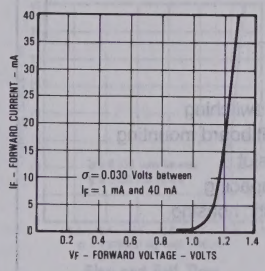
**Normalized Output Current vs Forward Current**



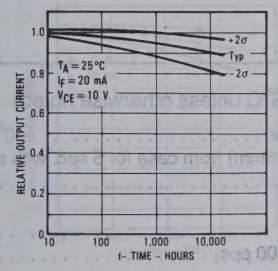

**Normalized Output Current vs Ambient Temperature**



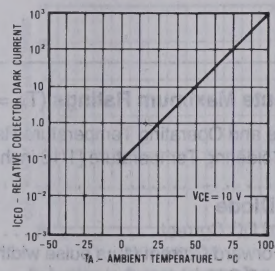

**Forward Current vs Forward Voltage Input Diode**



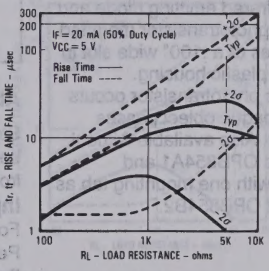

**Relative Output Current vs Time**



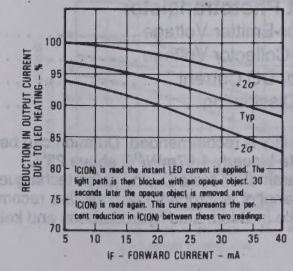

**Collector Dark Current vs Ambient Temperature**




**Rise and Fall Time vs Load Resistance**



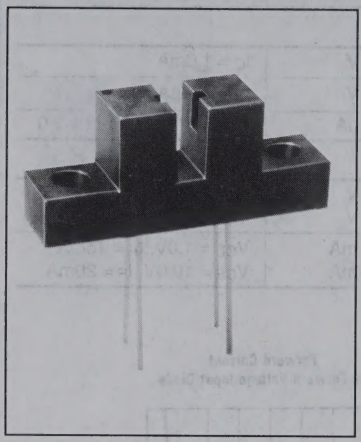

**Reduction in Output Current Due to LED Heating vs Forward Current**

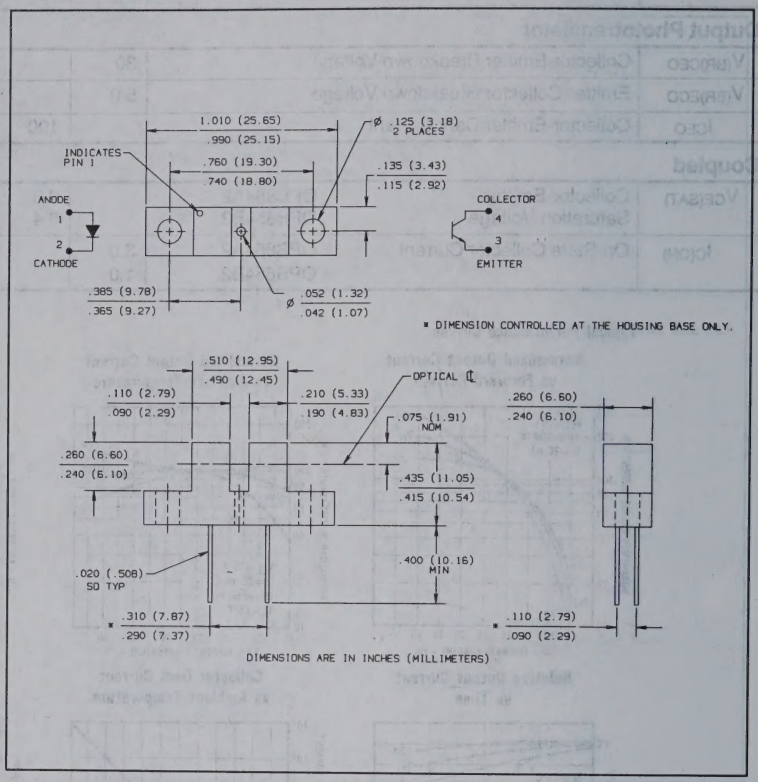

+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Slotted Optical Switches
## Types OPB854A3, OPB854B3






### Features

- Non-contact switching
- Printed circuit board mounting
- 0.100" wide slot
- 0.300" lead spacing
- Opaque plastic housing

### Description

The OPB854A3 and OPB854B3 each consist of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .100" wide slot in an inexpensive plastic housing. Switching of the phototransistor occurs whenever an opaque object passes through the slot. Also available without mounting tab as OPB854A1 and OPB854B1, or with one mounting tab as OPB854A2 and OPB854B2.

### Replaces

KT850C, KT851C

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 100mW(2) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 30mA |
| Power Dissipation | 100mW |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

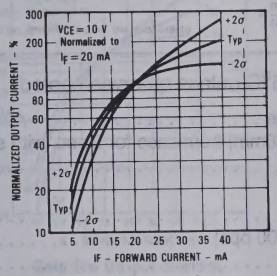
# Types OPB853A1, OPB853A2, OPB853A3

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

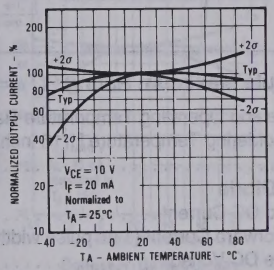
| SYMBOL | PARAMETER | | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| **Output Photodarlington** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 15 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | 100 | nA | $V_{CE}$ = 10V |
| **Coupled** | | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | | | 1.0 | V | $I_C$ = 1.8mA, $I_F$ = 10mA |
| $I_{C(ON)}$ | On-State Collector Current | OPB853A1 | 2.5 | | mA | $V_{CE}$ = 1.5V, $I_F$ = 5mA |
| | | OPB853A2 | 5.0 | | mA | $V_{CE}$ = 1.5V, $I_F$ = 5mA |
| | | OPB853A3 | 10.0 | | mA | $V_{CE}$ = 1.5V, $I_F$ = 5mA |

**Typical Performance Curves**

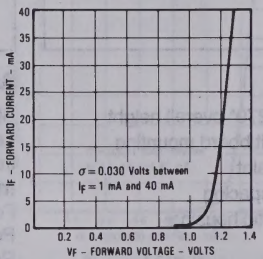
**Normalized Output Current vs Forward Current**



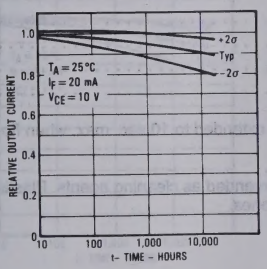

**Normalized Output Current vs Ambient Temperature**



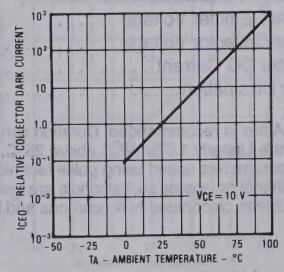

**Forward Current vs Forward Voltage Input Diode**



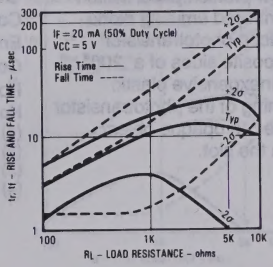

**Relative Output Current vs Time**



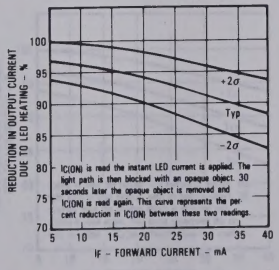

**Collector Dark Current vs Ambient Temperature**




**Rise and Fall Time vs Load Resistance**



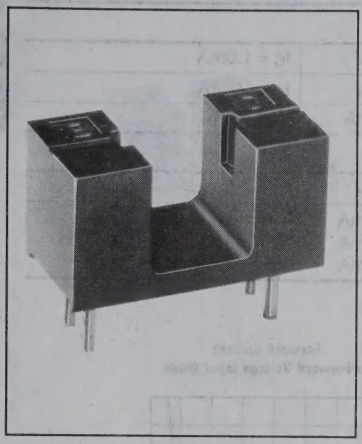

**Reduction in Output Current Due to LED Heating vs Forward Current**

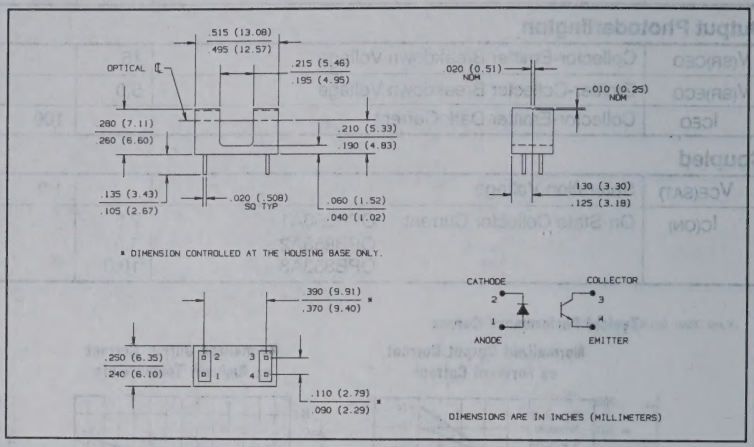

+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the per cent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton. Texas 75006 (214)323-2200 Fax (214)323-2396

# Slotted Optical Switch
## Type OPB855






### Features

- Low profile .270" overall height
- Printed circuit board mounting
- 0.205" wide slot
- 0.380" lead spacing
- Opaque plastic housing

### Description

The OPB855 low profile optical switch consists of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .200" wide slot in an inexpensive plastic housing. Switching of the phototransistor occurs whenever an opaque object passes through the slot.

### Replaces

KT855

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Input Diode**

| | |
|---|---|
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 100mW(2) |

**Output Phototransistor**

| | |
|---|---|
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 30mA |
| Power Dissipation | 100mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

# Type OPB855

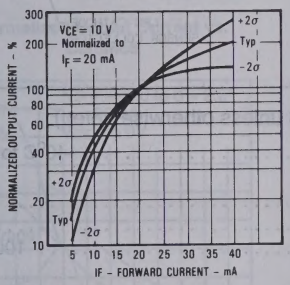
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.5 | V | $I_F$ = 40mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.4 | V | $I_C$ = 400µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current | 500 | | µA | $V_{CE}$ = 5.0V, $I_F$ = 20mA |

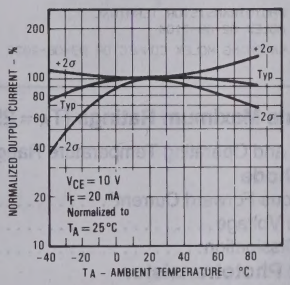


## Typical Performance Curves

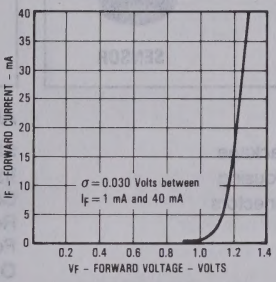
**Normalized Output Current vs Forward Current**



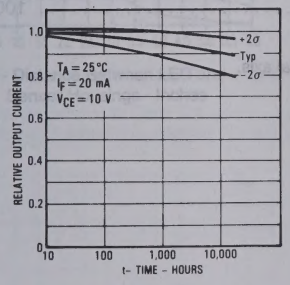

**Normalized Output Current vs Ambient Temperature**



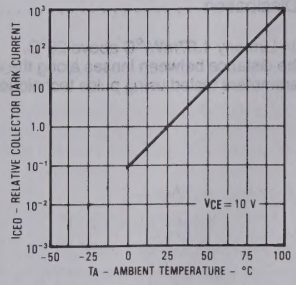

**Forward Current vs Forward Voltage Input Diode**



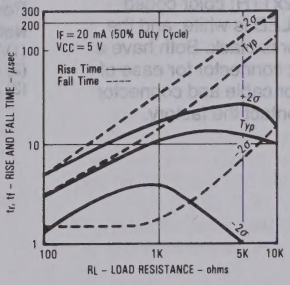

**Relative Output Current vs Time**



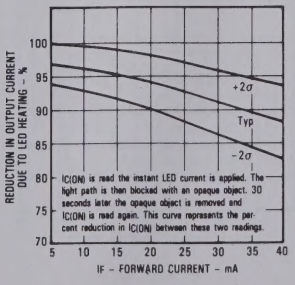

**Collector Dark Current vs Ambient Temperature**




**Rise and Fall Time vs Load Resistance**

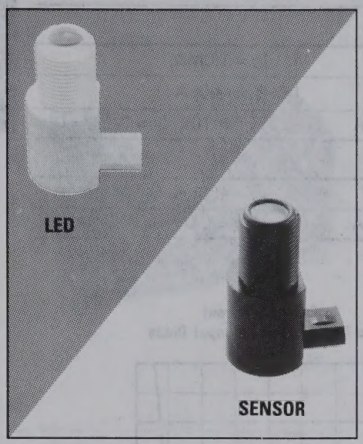


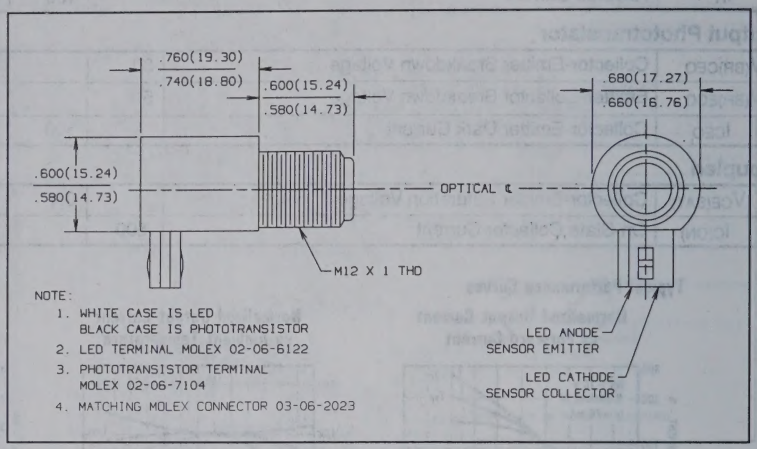

**Reduction in Output Current Due to LED Heating vs Forward Current**


+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Wide Gap Optical Sensor
## Type OPB856




### Features

- Industrial package
- Threaded housing
- Molded connectors

### Description

The OPB856 consists of an LED and a phototransistor each mounted in a threaded (M12x1TH) color coded housing. The LED is white, and the phototransistor is black. Both have a molded Molex connector for ease of installation. For cable and connector operations, contact the factory.

### Replaces

K-8050

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +85°C |
| **Input Diode** | |
| Continuous Forward Current | 40mA |
| Reverse Voltage | 2.0V |
| Power Dissipation | 100mW(1) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 100mW(1) |

**Notes:**
(1) Derate Linearly 1.67mW/°C above 25°C.
(2) d is the distance between lenses along the optical axis.
(3) All parameters tested using pulse technique.

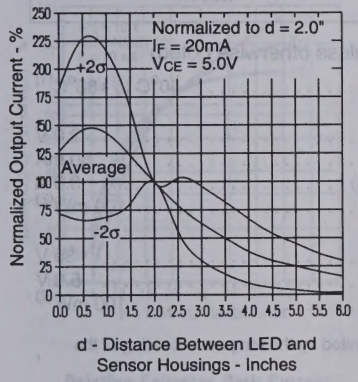
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Type OPB856

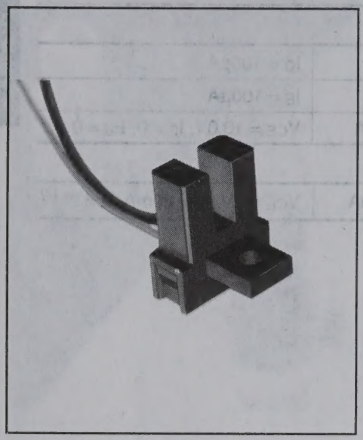
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

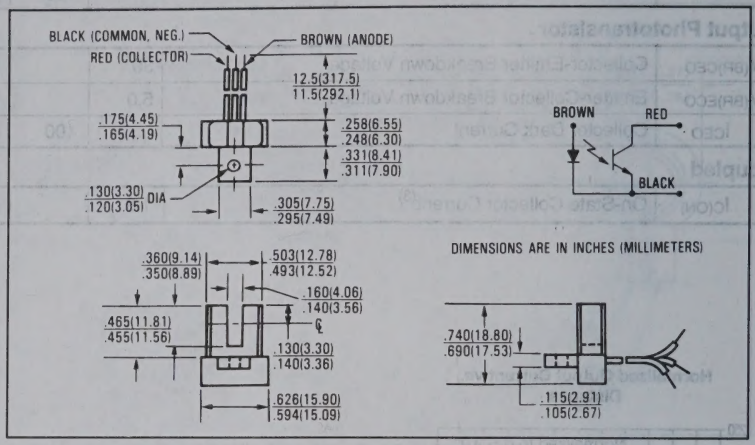
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 100µA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector Dark Current | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $I_{C(ON)}$ | On-State Collector Current(3) | 1.8 | | mA | $V_{CE}$ = 5V, $I_F$ = 20mA, d = 2" (2) |

**Normalized Output Current vs. Distance**



# Slotted Optical Switch
## Type OPB857






### Features

- Non-contact switching
- Three lead wires for electrical connection
- Sealed plastic housing
- Fast switching speed

### Description

The OPB857 consists of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a 0.15" (3.81 mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot. The low cost plastic housing reduces possible interference from ambient light and provides dirt and dust protection. 11.5" (292.1 mm) minimum length lead wires ease assembly where PC board mounting is not practical.

The OPB857 uses an OP140 or OP240 LED and OP550 family sensor.

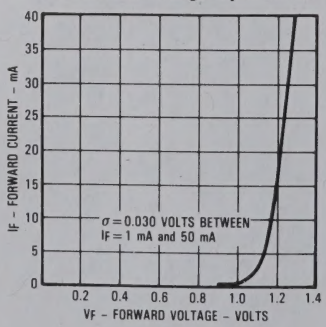
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +80°C(1) |
| **Input Diode** | |
| Reverse Voltage | 2.0 V |
| Continuous Forward Current | 50 mA |
| Peak Forward Current (1 us pulse width, 300 pps) | 3.0 A |
| Power Dissipation | 100 mW(2) |
| **Phototransistor** | |
| Collector-Emitter Voltage | 30 V |
| Emitter-Collector Voltage | 5.0 V |
| Power Dissipation | 100 mW(2) |

**Notes:**
(1) Maximum storage and operating temperature are limited by the temperature rating of the lead wires.
(2) Derate linearly 1.82 mW/°C above 25°C.
(3) Plastic housing is soluble in chlorinated hydrocarbons and ketones. Methanol or isopropanol alcohols are recommended as cleaning agents.

### Typical Performance Curves

**Forward Current vs Forward Voltage Input Diode**



# Type OPB857

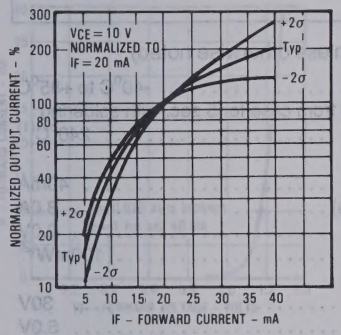
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0 V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 1.00 mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100 µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10.0 V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.40 | V | $I_C$ = 1.50 mA, $I_F$ = 20 mA |
| $I_{C(ON)}$ | On-State Collector Current | 1.50 | | mA | $V_{CE}$ = 10.0 V, $I_F$ = 20 mA |

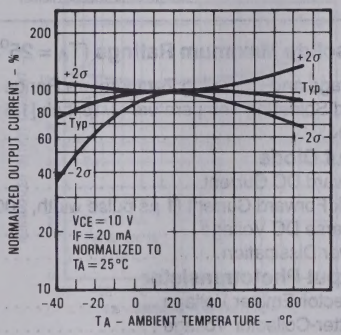


## Typical Performance Curves

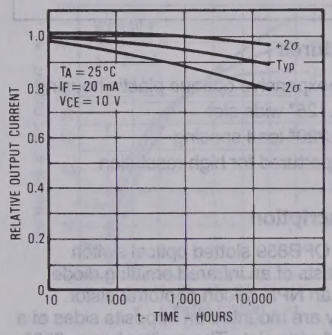
**Normalized Output Current vs Forward Current**



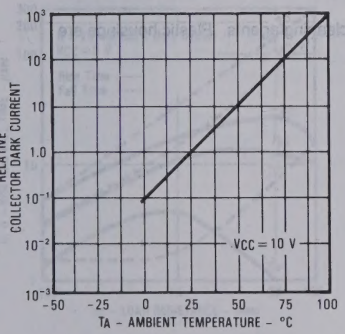

**Normalized Output Current vs Ambient Temperature**



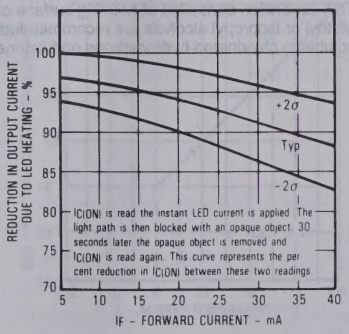

**Relative Output Current vs Time**



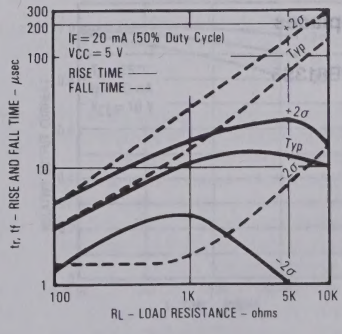

**Relative Collector Dark Current vs Ambient Temperature**




**Reduction in Output Current Due to LED Heating vs Forward Current**

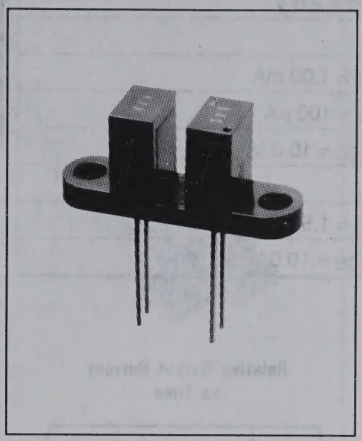

+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the per cent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

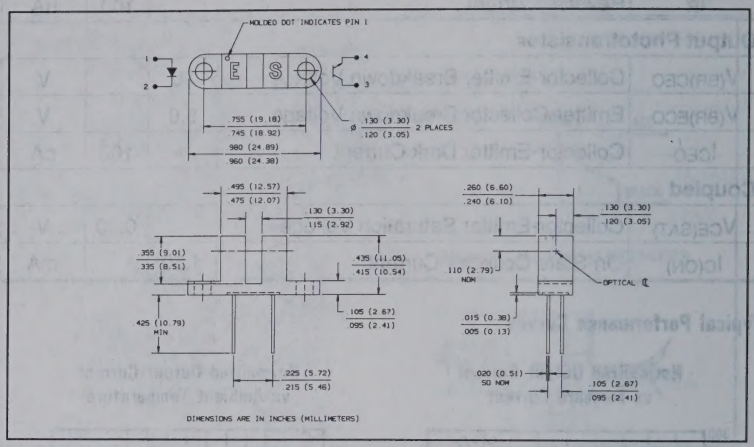
**Rise and Fall Time vs Load Resistance**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# High Resolution Slotted Optical Switch
## Type OPB859






### Features

- Inexpensive opaque plastic housing
- 0.125" wide slot
- 0.220" lead spacing
- Apertured for high resolution

### Description

The OPB859 slotted optical switch consists of an infrared emitting diode and an NPN silicon phototransistor. They are mounted on opposite sides of a .125" wide slot. The emitter has a .050" x .050" aperture while the phototransistor has a .005" x .050" aperture.

### Replaces

OPB813S5

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Storage and Operating Temperature Range ..... -40°C to +85°C
Lead Soldering Temperature (1/16 inch [1.6 mm] from case for 5 sec. with soldering iron) ..... 240°C(1)

**Input Diode**

Forward DC Current ..... 40mA
Peak Forward Current (1 µs pulse width, 300 pps) ..... 3.0A
Reverse DC Voltage ..... 2.0V
Power Dissipation ..... 100mW(2)

**Output Phototransistor**

Collector-Emitter Voltage ..... 30V
Emitter-Collector Voltage ..... 5.0V
Power Dissipation ..... 100mW(2)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.67 mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) This dimension controlled at housing surface only.
(5) Methyl or isopropyl alcohols are recommended as cleaning agents. Plastic housings are soluble in chlorinated hydrocarbons and ketones.

# Type OPB859

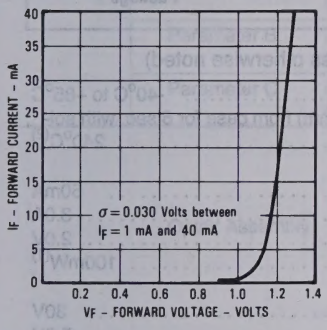
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.7 | V | $I_F$ = 20 mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0 V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakjdown Voltage | 30 | | V | $I_C$ = 1.0 mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100 µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10 V |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage | | 0.40 | V | $I_C$ = 125 µA, $I_F$ = 20 mA |
| $I_{C(ON)}$ | On-State Collector Current | 250 | | µA | $V_{CE}$ = 10.0 V, $I_F$ = 20 mA |

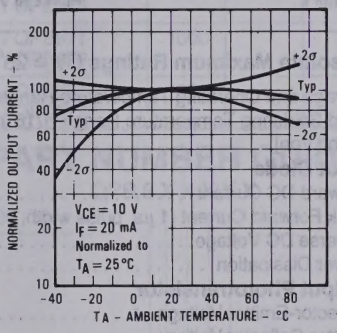
SLOTTED OPTICAL SWITCHES

## Typical Performance Curves

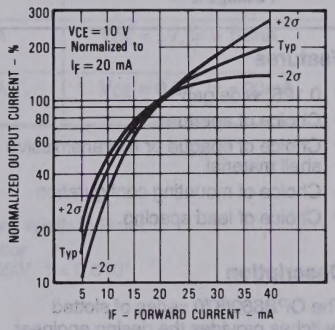
**Forward Current vs Forward Voltage Input Diode**



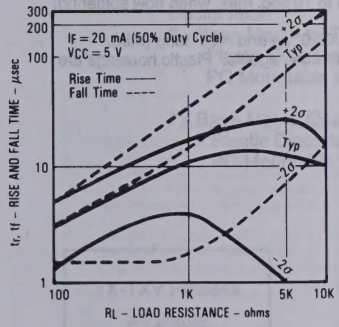

**Normalized Output Current vs Ambient Temperature**



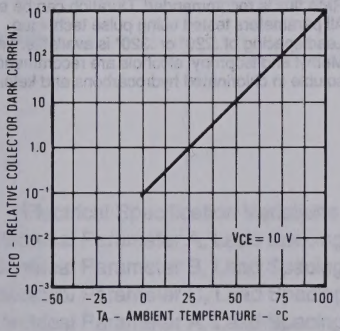

**Normalized Output Current vs Forward Current**



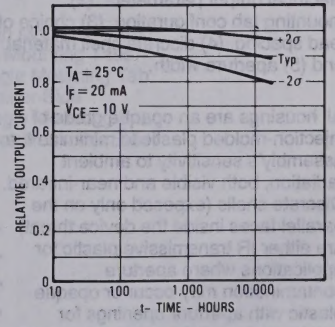

**Rise and Fall Time vs Load Resistance**




**Collector Dark Current vs Ambient Temperature**

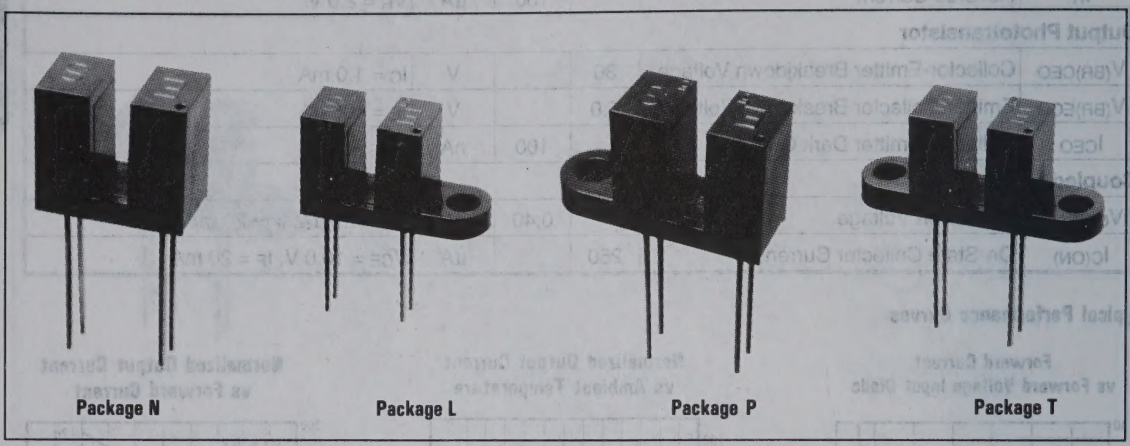



**Relative Output Current vs Time**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Slotted Optical Switches
## Types OPB860, OPB870 Series



Package N | Package L | Package P | Package T

### Features

- 0.125" wide gap
- Choice of aperture
- Choice of opaque or IR transmissive shell material
- Choice of mounting configuration
- Choice of lead spacing

### Description

The OPB860/870 series of slotted switches provides the design engineer with the flexibility of a custom device from a standard product line. Building from a standard housing with a .125" wide slot, the user can specify (1) electrical output parameters, (2) mounting tab configuration, (3) choice of lead spacing, (4) discrete shell material, and (5) aperture width.

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed only on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic with aperture openings for maximum protection against ambient light.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature Range [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 100mW(1) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 30mA |
| Power Dissipation | 100mW(1) |

**Notes:**
(1) Derate linearly 1.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Lead spacing of .220" or .320" is available. Leads are 0.20" sq and .425" long (min).
(5) Methyl and isopropyl alcohols are recommended as cleaning agents. Plastic housings are soluble in chlorinated hydrocarbons and ketones.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB860, OPB870 Series

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 30 | | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 5.0 | | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | | 100 | nA | $V_{CE}$ = 10V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage: | | | | | | |
| | Parameter A | OPB860 / OPB870<br>OPB865 / OPB875 | | | 0.4 | V | $I_C$ = 400µA, $I_F$ = 20mA |
| | Parameter B | OPB861 / OPB871<br>OPB866 / OPB876 | | | 0.4 | V | $I_C$ = 800µA, $I_F$ = 10mA |
| | Parameter C | OPB862 / OPB872<br>OPB867 / OPB877 | | | 0.6 | V | $I_C$ = 1800µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current: | | | | | | |
| | Parameter A | OPB860 / OPB870<br>OPB865 / OPB875 | 500 | | | µA | $V_{CE}$ = 10V, $I_F$ = 20mA |
| | Parameter B | OPB861 / OPB871<br>OPB866 / OPB876 | 1000 | | | µA | $V_{CE}$ = 5V, $I_F$ = 10mA |
| | Parameter C | OPB862 / OPB872<br>OPB867 / OPB877 | 1800 | | | µA | $V_{CE}$ = 0.6V, $I_F$ = 20mA |

## PART NUMBER GUIDE

OPB 8 X X X X X

Optek Assembly

Phototransistor Output Family

Discrete Shell Material Designation

6 - Base Mount IR Transmissive Plastic Discrete Shell PC Mountable Leads

7 - Base Mount Opaque Plastic Discrete Shell PC Mountable Leads

Aperture Width In Front of Sensor
5 = 0.050" 1 = 0.010"

Aperture Width In Front of Emitter
5 = 0.050" 1= 0.010"*

Mounting Configurations

T - Both Mounting Tabs
N - No Mounting Tabs
L - Single Mounting Tab Emitter Side
P - Single Mounting Tab Phototransistor Side

Electrical Specification Variations

0 - Electrical Parameter A, Lead Spacing 0.320"
1 - Electrical Parameter B, Lead Spacing 0.320"
2 - Electrical Parameter C, Lead Spacing 0.320"
5 - Electrical Parameter A, Lead Spacing 0.220"
6 - Electrical Parameter B, Lead Spacing 0.220"
7 - Electrical Parameter C, Lead Spacing 0.220"

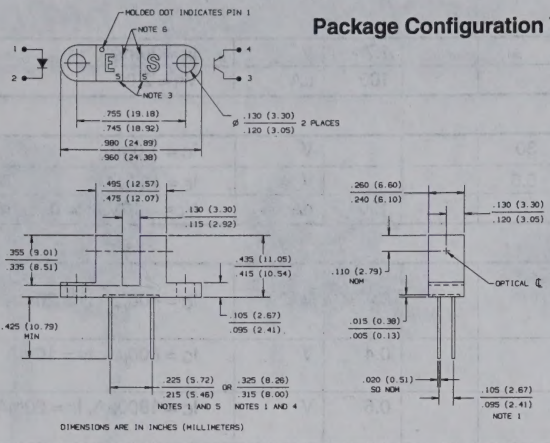
*Assemblies with dual 0.010" apertures are currently available with electrical parameter "A" only.

TX-TXV Process Available See Hi-Rel Section

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

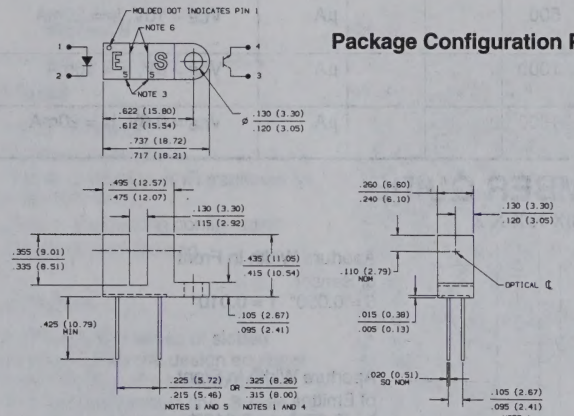
OPTEK

## Package Configuration T



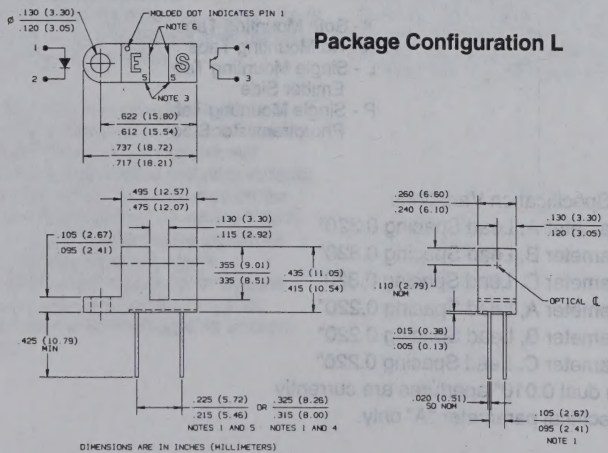

DIMENSIONS ARE IN INCHES (MILLIMETERS)

## Package Configuration P



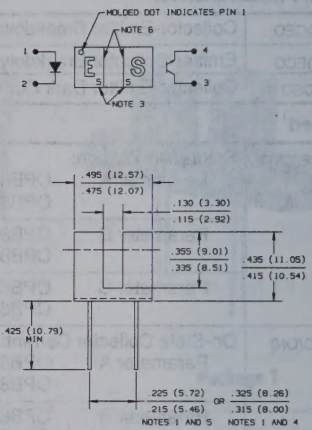

DIMENSIONS ARE IN INCHES (MILLIMETERS)

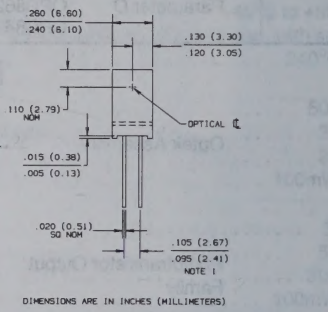
## Package Configuration L




DIMENSIONS ARE IN INCHES (MILLIMETERS)

## Package Configuration N




DIMENSIONS ARE IN INCHES (MILLIMETERS)

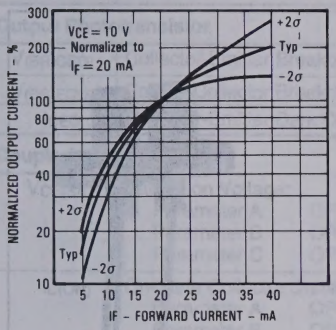
**Notes:**

(1) Dimension controlled at housing surace only.
(2) Methanol and isopropanol alcohols are recommended as cleaning agents. Housings are soluble in chlorinated hydrocarbons and ketones. Highly activated, water soluble fluxes may attack housings in some situations.
(3) Molded number to identify aperture size. See part number guide.
(4) OPB860, OPB861, OPB862, OPB870, OPB871, OPB872.
(5) OPB865, OPB866, OPB867, OPB875, OPB876, OPB877.
(6) Dimensions of aperture opening dependent on housing. See part number guide.

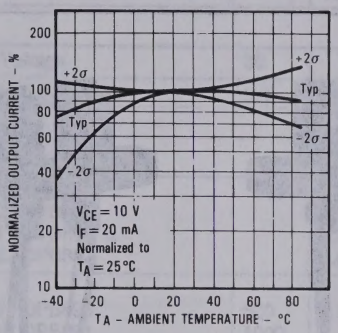
# Types OPB860, OPB870 Series

## Typical Performance Curves

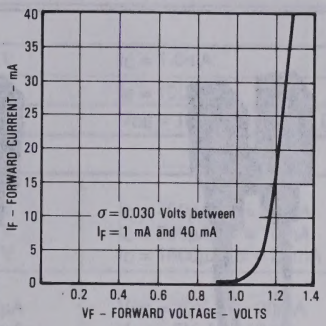
### Normalized Output Current vs Forward Current



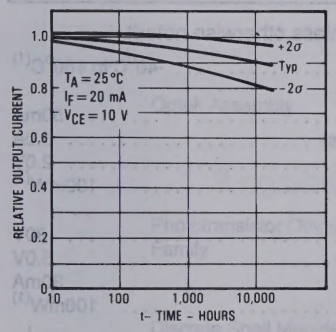

### Normalized Output Current vs Ambient Temperature



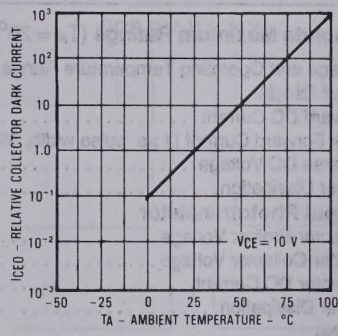

### Forward Current vs Forward Voltage Input Diode



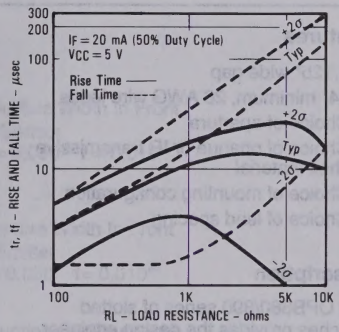

### Relative Output Current vs Time




### Collector Dark Current vs Ambient Temperature

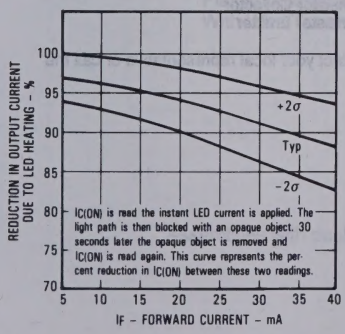



### Rise and Fall Time vs Load Resistance

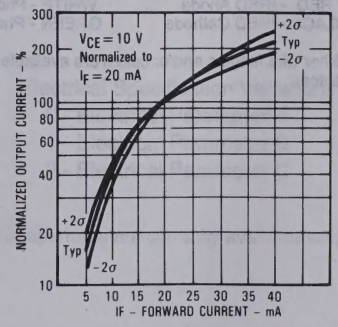



## All Part Numbers Ending in "1"

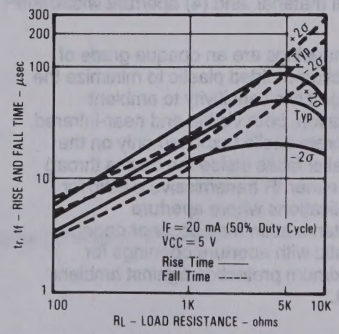
### Reduction in Output Current Due to LED Heating vs Forward Current


+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

### Normalized Output Current vs Input Current

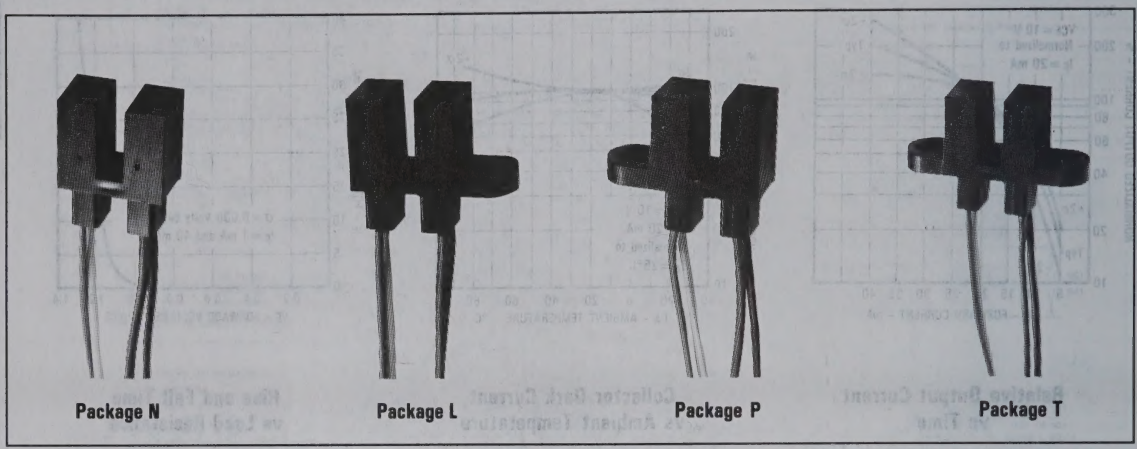



### Rise and Fall Time vs Load Resistance




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Slotted Optical Switches
## Types OPB880, OPB890 Series




### Features

- 0.125" wide gap
- 24" minimum, 26 AWG wire leads
- Choice of aperture
- Choice of opaque or IR transmissive shell material
- Choice of mounting configuration
- Choice of lead spacing

### Description

The OPB880/890 series of slotted switches provides the design engineer with the flexibility of a custom device from a standard product line. Building from a standard housing with a .125" wide slot, the user can specify (1) electrical output parameters, (2) mounting tab configuration, (3) discrete shell material, and (4) aperture width.

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed only on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic with aperture openings for maximum protection against ambient light.

**Replaces** KT880/KT890 Series
**Upgrades** OPB880/OPB890 Series

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage and Operating Temperature Range | -40°C to +80°C(1) |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 3.0A |
| Reverse DC Voltage | 2.0V |
| Power Dissipation | 100mW(1) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Collector DC Current | 30mA |
| Power Dissipation | 100mW(1) |

**Notes:**

(1) Derate linearly 1.82mW/°C above 25°C (Maximum storage and operating temperature is limited by the temperature rating of the lead wires)

(2) All parameters tested using pulse technique.

(3) The OPB880/OPB890 wire terminations are 24" of 7 strand, 26 AWG, UL 1429 insulated wire on each terminal. The devices incorporate a wire strain relief at the housing surface. The insulation colors and functions are:

| | |
|---|---|
| RED - IRED Anode | WHITE - Phototransistor Collector |
| BLACK - IRED Cathode | GREEN - Phototransistor Emitter |

Other wire lengths and/or colors are available. Contact your local representative or call the factory.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB880, OPB890 Series

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.7 | V | $I_F$ = 20mA |
| $I_R$ | Reverse Current | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$ = 1.0mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100 | nA | $V_{CE}$ = 10V, $I_F$ = 0, $E_e$ = 0 |
| **Coupled** | | | | | |
| $V_{CE(SAT)}$ | Saturation Voltage: | | | | |
| | Parameter A OPB880 / OPB890 | | 0.4 | V | $I_C$ = 400µA, $I_F$ = 20mA |
| | Parameter B OPB881 / OPB891 | | 0.4 | V | $I_C$ = 800µA, $I_F$ = 10mA |
| | Parameter C OPB882 / OPB892 | | 0.6 | V | $I_C$ = 1800µA, $I_F$ = 20mA |
| $I_{C(ON)}$ | On-State Collector Current: | | | | |
| | Parameter A OPB880 / OPB890 | 500 | | µA | $V_{CE}$ = 10V, $I_F$ = 20mA |
| | Parameter B OPB881 / OPB891 | 1000 | | µA | $V_{CE}$ = 5V, $I_F$ = 10mA |
| | Parameter C OPB882 / OPB892 | 1800 | | µA | $V_{CE}$ = 0.6V, $I_F$ = 20mA |

## PART NUMBER GUIDE

OPB 8 X X X X X

Optek Assembly

Phototransistor Output Family

Discrete Shell Material Designation
8 - Base Mount IR Transmissive Plastic Discrete Shell With Wire Termination
9 - Base Mount Opaque Plastic Discrete Shell With Wire Termination

Electrical Specification Variations
0 - Electrical Parameter A
1 - Electrical Parameter B
2 - Electrical Parameter C

Aperture Width In Front of Sensor
5 = 0.050" 1 = 0.010"

Aperture Width In Front of Emitter
5 = 0.050" 1= 0.010"*

Mounting Configurations
T - Both Mounting Tabs
N - No Mounting Tabs
L - Single Mounting Tab Emitter Side
P - Single Mounting Tab Phototransistor Side

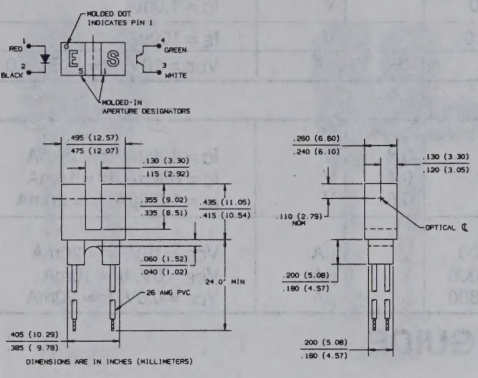
*Assemblies with dual 0.010" apertures are currently available with electrical parameter "A" only.



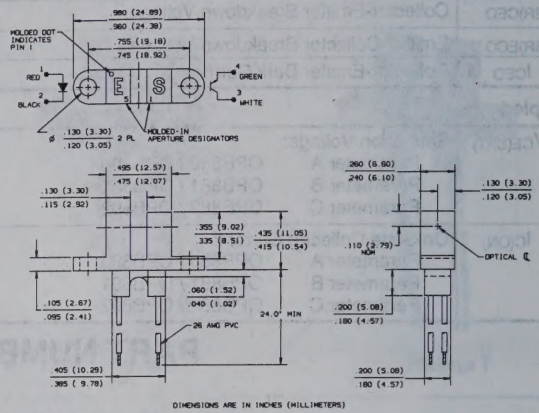
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

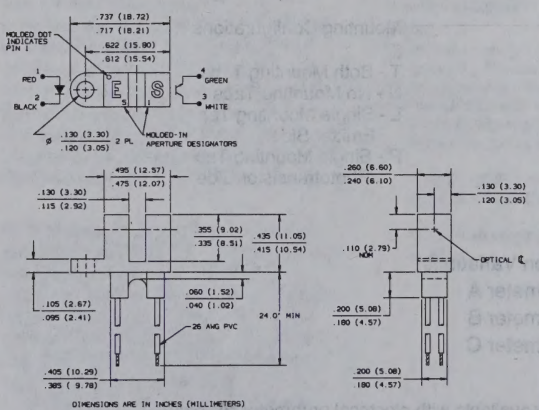
## Package N



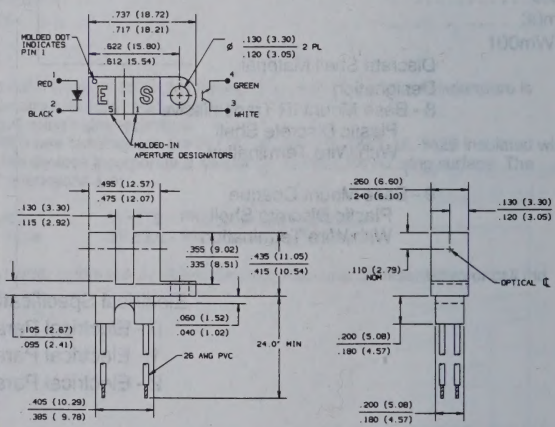

## Package T




## Package L



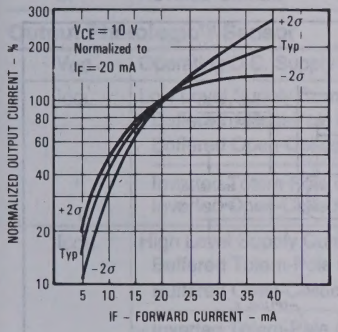

## Package P



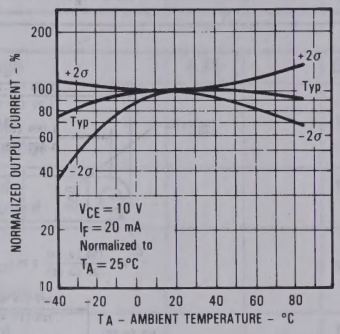
# Types OPB880, OPB890 Series

## Typical Performance Curves

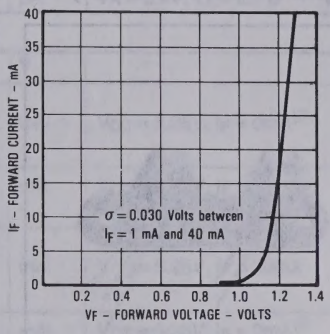
### Normalized Output Current vs Forward Current



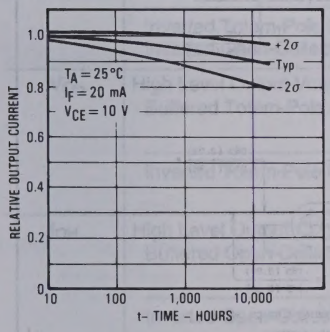

### Normalized Output Current vs Ambient Temperature



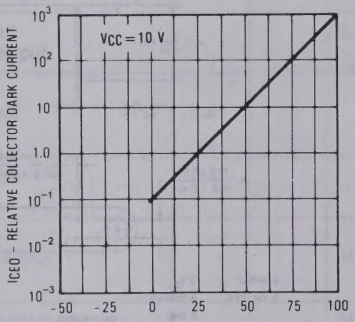

### Forward Current vs Forward Voltage Input Diode



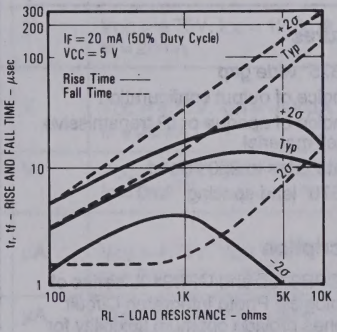

### Relative Output Current vs Time




### Collector Dark Current vs Ambient Temperature

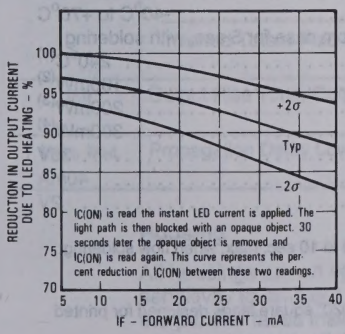



### Rise and Fall Time vs Load Resistance

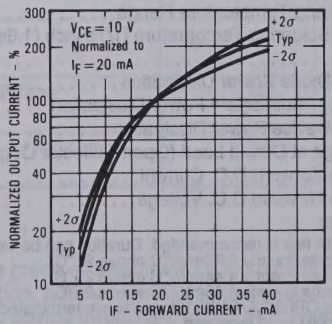



## All Part Numbers Ending in "1"

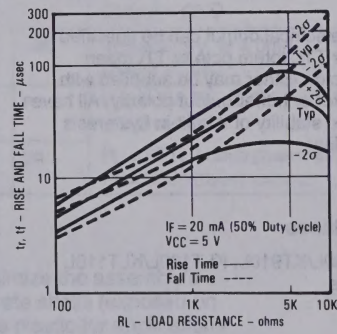
### Reduction in Output Current Due to LED Heating vs Forward Current


+2σ
Typ
-2σ
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

### Normalized Output Current vs Input Current

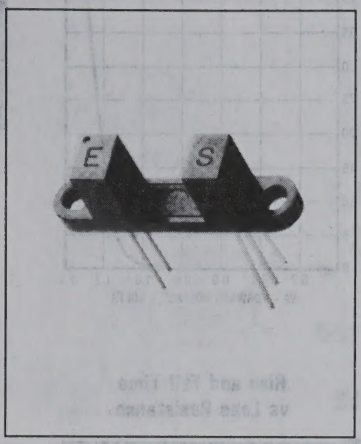


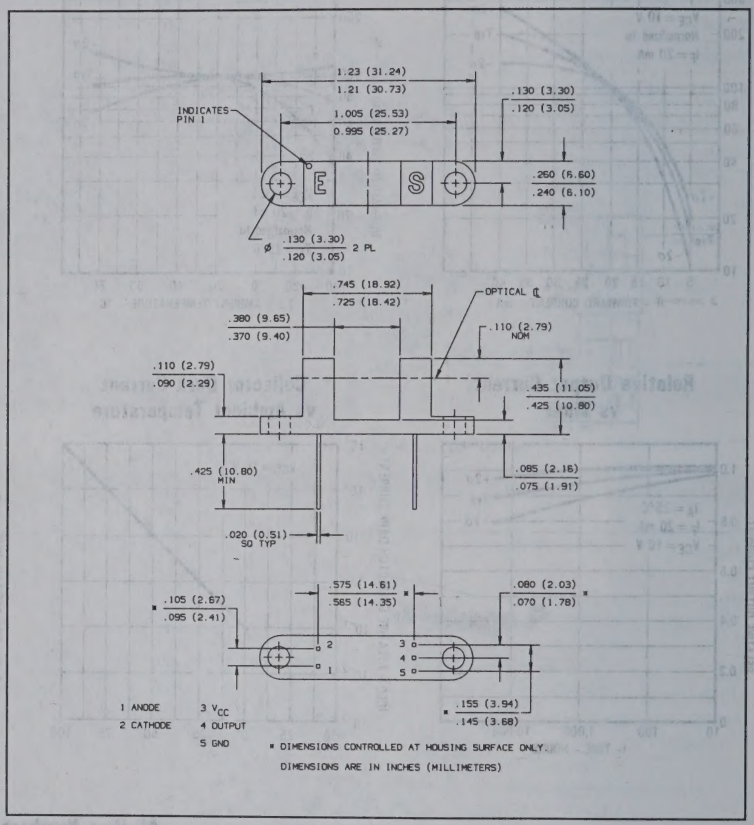

### Rise and Fall Time vs Load Resistance




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Photologic™ Slotted Optical Switches
## Types OPB900L, OPB910L "Wide Gap" Series




### Features

- 0.375" wide gap
- Choice of output configuration
- Choice of opaque or IR transmissive shell material
- Data rates to 250 kBaud
- 0.570" lead spacing

### Description

The OPB900L and OPB910L series of Photologic™ Photo Integrated Circuit Switches provide optimum flexibility for the design engineer. Building from a standard housing with a .375" wide slot, the user can specify (1) type and polarity of TTL output and (2) discrete shell material. Available with wire leads as OPB900W/OPB910W series.

The electrical output can be specified as either TTL totem pole or TTL open collector. Either may be supplied with inverter or buffer output polarity. All have added stability of a built-in hysteresis amplifier.

### Replaces

KT900L/KT910L, KLT100L/KLT110L series

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (Not to exceed 3 sec.) | 10V |
| Storage Temperature Range | -40°C to +85°C |
| Operating Temperature Range | -40°C to +70°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |
| Input Diode Power Dissipation | 100mW(2) |
| Output Photologic™ Power Dissipation | 200mW(3) |
| Total Device Power Dissipation | 300mW(4) |
| Voltage at Output Lead (Open Collector Output) | 35V |
| Diode Forward D.C. Current | 40mA |
| Diode Reverse D.C. Voltage | 2V |

**Notes:**

(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.22mW/°C above 25°C.
(3) Derate linearly 4.44mW/°C above 25°C.
(4) Derate linearly 6.66mW/°C above 25°C.
(5) The OPB900L/OPB910L series are terminated with .020" square leads designed for printed circuit board mounting.
(6) Normal application would be with light source blocked, simulated by $I_F$ = 0mA.
(7) All parameters tested using pulse technique.
(8) Methyl or isopropyl alcohols are recommended as cleaning agents. Plastic housings are soluble in chlorinated hydrocabons and ketones.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB900L, OPB910L Series

**Electrical Characteristics** ($T_A$ = -40°C to +70°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20mA, $T_A$ = 25°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V, $T_A$ = 25°C |
| **Output Photologic™ Sensor** | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | 4.75 | | 5.25 | V | |
| $I_{CCL}$ | Low Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(6) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 20mA |
| $I_{CCH}$ | High Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 20mA |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(6) |
| $V_{OL}$ | Low Level Output Voltage:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 0mA(6) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 20mA |
| $V_{OH}$ | High Level Output Voltage:<br>Buffered Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75V, $I_{OH}$ = -800µA<br>$I_F$ = 20mA |
| | Inverted Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75V, $I_{OH}$ = -800µA<br>$I_F$ = 0mA(6) |
| $I_{OH}$ | High Level Output Current:<br>Buffered Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V<br>$I_F$ = 20mA, $T_A$ = 25°C |
| | Inverted Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V,<br>$I_F$ = 0mA, $T_A$ = 25°C |
| $I_{F(+)}$ | LED Positive-Going Threshold Current | | | 20 | mA | $V_{CC}$ = 5V, $T_A$ = 25°C |
| $I_{F(+)}/I_{F(-)}$ | Hysteresis | | 2.0 | | | $V_{CC}$ = 5V |
| $I_{OS}$ | Short Circuit Output Current:<br>Buffered Totem-Pole Output | -30 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 20mA<br>Output = GND |
| | Inverted Totem-Pole Output | -30 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA<br>Output = GND |
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | 70 | | ns | $V_{CC}$ = 5V, $T_A$ = 25°C<br>$I_F$ = 0 or 20mA |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay Low-High & High-Low | | 5.0 | | µs | $R_L$ = 8TTL Loads (Totem Pole)<br>$R_L$ = 360Ω (Open Collector) |

### Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic for maximum protection against ambient light.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Types OPB900L, OPB910L Series

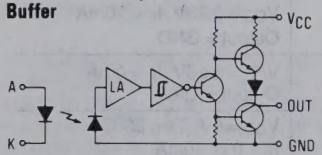
## PART NUMBER GUIDE

OPB 9 X X X X X

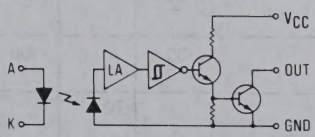
- Optek Assembly
- Photologic™ Photo Integrated Circuit Sensor Family
- Discrete Shell Material Designation
  - 0 - Wide Gap IR Transmissive Plastic Discrete Shell
  - 1 - Wide Gap Opaque Plastic Discrete Shell
- Electrical Specification Variations
  - 0 - Buffered Totem-Pole Output
  - 1 - Buffered Open-Collector Output
  - 2 - Inverted Totem-Pole Output
  - 3 - Inverted Open-Collector Output
- Mounting Configurations
  - L - Solder Leads Termination
  - W - Wire Termination
- Aperture Width In Front of Emitter 5 = 0.050"
- Aperture Width In Front of Sensor 5 = 0.050"

**Schematics**

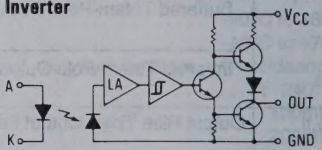
**OPB900/OPB910 (Totem-Pole Output) Buffer**



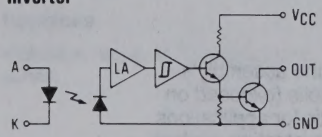

**OPB901/OPB911 (Open-Collector Output) Buffer**




**OPB902/OPB912 (Totem-Pole Output) Inverter**




**OPB903/OPB913 (Open-Collector Output) Inverter**

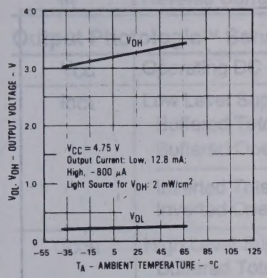


# Types OPB900L, OPB910L Series

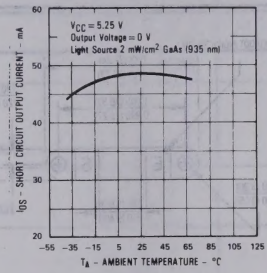
## Typical Performance Curves

### OPB900L, OPB902L, OPB910L, OPB912L

**Output Voltage vs Ambient Temperature**

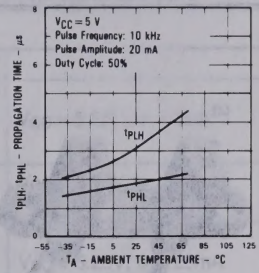

$V_{OH}$
$V_{OL}$ – OUTPUT VOLTAGE – V
$V_{CC}$ = 4.75 V
Output Current: Low, 12.8 mA;
High, –800 μA
Light Source for $V_{OH}$: 2 mW/cm²
$V_{OL}$
$T_A$ – AMBIENT TEMPERATURE – °C

**Short Circuit Output Current vs Ambient Temperature**



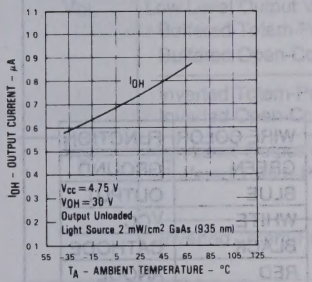

### All Assemblies

**Propagation Time vs Ambient Temperature**

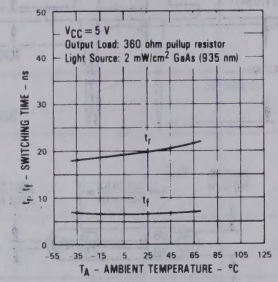



### OPB901L, OPB903L, OPB911L, OPB913L

**Output Current (High) vs Ambient Temperature**

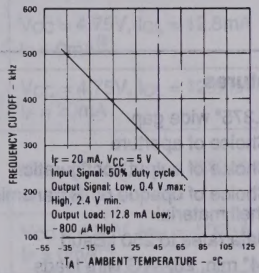



**Rise Time and Fall Time vs Ambient Temperature**


$V_{CC}$ = 5 V
Output Load: 360 ohm pullup resistor
Light Source: 2 mW/cm² GaAs (935 nm)
$t_r$
$t_f$
$t_r$, $t_f$ – SWITCHING TIME – ns
$T_A$ – AMBIENT TEMPERATURE – °C

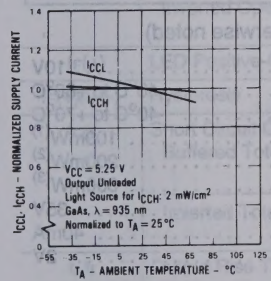
### All Assemblies

**Data Rate vs Ambient Temperature**


$I_F$ = 20 mA, $V_{CC}$ = 5 V
Input Signal: 50% duty cycle
Output Signal: Low, 0.4 V max;
High, 2.4 V min.
Output Load: 12.8 mA Low;
–800 μA High
FREQUENCY CUTOFF – kHz
$T_A$ – AMBIENT TEMPERATURE – °C

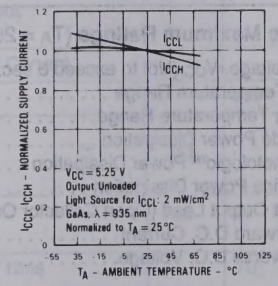
### OPB902L, OPB903L, OPB912L, OPB913L

**Normalized Supply Current vs Ambient Temperature**


$I_{CCL}$
$I_{CCH}$
$V_{CC}$ = 5.25 V
Output Unloaded
Light Source for $I_{CCH}$: 2 mW/cm²
GaAs, λ = 935 nm
Normalized to $T_A$ = 25°C
$I_{CCL}$, $I_{CCH}$ – NORMALIZED SUPPLY CURRENT
$T_A$ – AMBIENT TEMPERATURE – °C

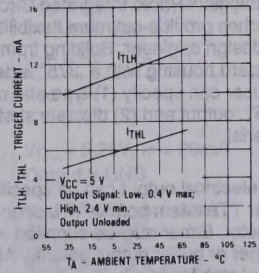
### OPB900L, OPB901L, OPB910L, OPB911L

**Normalized Supply Current vs Ambient Temperature**

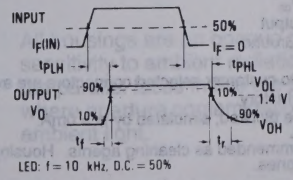

$I_{CCL}$
$I_{CCH}$
$V_{CC}$ = 5.25 V
Output Unloaded
Light Source for $I_{CCL}$: 2 mW/cm²
GaAs, λ = 935 nm
Normalized to $T_A$ = 25°C
$I_{CCL}$, $I_{CCH}$ – NORMALIZED SUPPLY CURRENT
$T_A$ – AMBIENT TEMPERATURE – °C

### All Assemblies

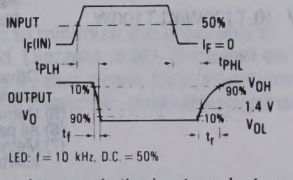
**Trigger Current vs Ambient Temperature**




### Switching Test Curve for Buffers

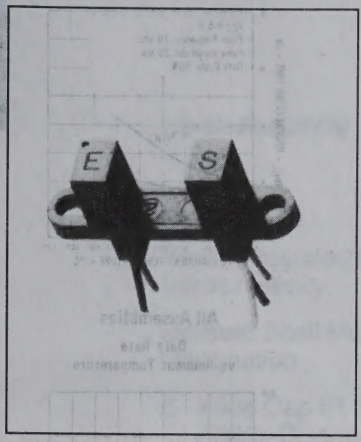


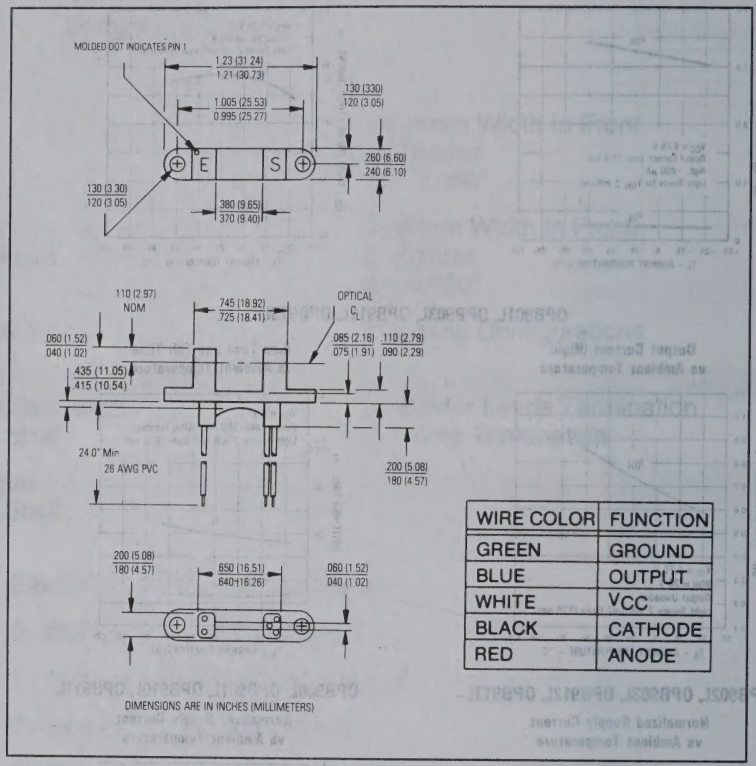

### Switching Test Curve for Inverters




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Photologic™ Slotted Optical Switches
## Types OPB900W, OPB910W "Wide Gap" Series




| WIRE COLOR | FUNCTION |
|---|---|
| GREEN | GROUND |
| BLUE | OUTPUT |
| WHITE | $V_{CC}$ |
| BLACK | CATHODE |
| RED | ANODE |

### Features

- 0.375" wide gap
- Choice of aperture
- Choice of output configuration
- Choice of opaque or IR transmissive shell material
- Data rates to 250 kBaud
- 24" min, 26AWG wire leads

### Description

The OPB900W and OPB910W series of Photologic™ Photo Integrated Circuit Switches provide optimum flexibility for the design engineer. Building from a standard housing with a .375" wide slot, the user can specify (1) type and polarity of TTL output and (2) discrete shell material.

The electrical output can be specified as either TTL totem pole or TTL open collector. Either may be supplied with inverter or buffer output polarity. All have added stability of a built-in hysteresis amplifier.

### Replaces

KT900W/KT910W KLT100W/KLT100W series.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (Not to exceed 3 sec.) | 10V |
| Storage Temperature Range | -40°C to +80°C |
| Operating Temperature Range | -40°C to +70°C |
| Input Diode Power Dissipation | 100mW(1) |
| Output Photologic™ Power Dissipation | 200mW(2) |
| Total Device Power Dissipation | 300mW(3) |
| Voltage at Output Lead (Open Collector Output) | 35V |
| Diode Forward D.C. Current | 40mA |
| Diode Reverse D.C. Voltage | 2V |

**Notes:**

(1) Derate linearly 2.22mW/°C above 25°C.
(2) Derate linearly 4.44mW/°C above 25°C.
(3) Derate linearly 6.66mW/°C above 25°C.
(4) The OPB900W/OPB910W series are terminated with 24 inches of 7 strand 26 AWG, UL 1429 insulated wire on each terminal. Insulation function and colors are :

| | |
|---|---|
| Red - IRED Anode | White - $V_{CC}$ |
| Black - IRED Cathode | Blue - Output |
| | Green - Ground |

Other wire lengths and/or colors in addition to customer selected connectors are available. Contact your local representative or call the factory.
(5) Normal application would be with light source blocked, simulated by $I_F$ = 0mA.
(6) All parameters tested using pulse technique.
(7) Methanol and isopropanol alcohols are recommended as cleaning agents. Housings are soluble in chlorinated hydrocarbons and ketones.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB900W, OPB910W Series

**Electrical Characteristics** ($T_A$ = -40°C to +70°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20mA, $T_A$ = 25°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V, $T_A$ = 25°C |
| **Output Photologic™ Sensor** | | | | | | |
| $V_{CC}$ | Operating DC Supply Voltage | 4.75 | | 5.25 | V | |
| $I_{CCL}$ | Low Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(5) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 20mA |
| $I_{CCH}$ | High Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 20mA |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(5) |
| $V_{OL}$ | Low Level Output Voltage:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 0mA(5) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 20mA |
| $V_{OH}$ | High Level Output Voltage:<br>Buffered Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75V, $I_{OH}$ = -800µA<br>$I_F$ = 20mA |
| | Inverted Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75V, $I_{OH}$ = -800µA<br>$I_F$ = 0mA(5) |
| $I_{OH}$ | High Level Output Current:<br>Buffered Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V<br>$I_F$ = 20mA, $T_A$ = 25°C |
| | Inverted Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V,<br>$I_F$ = 0mA, $T_A$ = 25°C |
| $I_F(+)$ | LED Positive-Going Threshold Current | | | 20 | mA | $V_{CC}$ = 5V, $T_A$ = 25°C |
| $I_F(+)/I_F(-)$ | Hysteresis | | 2.0 | | | $V_{CC}$ = 5V |
| $I_{OS}$ | Short Circuit Output Current:<br>Buffered Totem-Pole Output | -30 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 20mA<br>Output = GND |
| | Inverted Totem-Pole Output | -30 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA<br>Output = GND |
| $t_r$,$t_f$ | Output Rise Time, Output Fall Time | | 70 | | ns | $V_{CC}$ = 5V, $T_A$ = 25°C<br>$I_F$ = 0 or 20mA |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay Low-High & High-Low | | 5.0 | | µs | $R_L$ = 8TTL Loads (Totem Pole)<br>$R_L$ = 360Ω (Open Collector) |

## Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic for maximum protection against ambient light.



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Types OPB900W, OPB910W Series

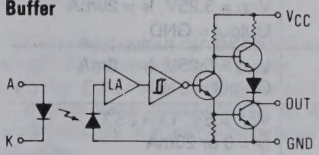
## PART NUMBER GUIDE

OPB 9 X X X X X

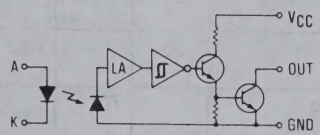
- Optek Assembly
- Photologic™ Photo Integrated Circuit Sensor Family
- Discrete Shell Material Designation
  - 0 - Wide Gap IR Transmissive Plastic Discrete Shell
  - 1 - Wide Gap Opaque Plastic Discrete Shell
- Electrical Specification Variations
  - 0 - Buffered Totem-Pole Output
  - 1 - Buffered Open-Collector Output
  - 2 - Inverted Totem-Pole Output
  - 3 - Inverted Open-Collector Output
- Mounting Configurations
  - L - Solder Leads Termination
  - W - Wire Termination
- Aperture Width In Front of Emitter 5 = 0.050"
- Aperture Width In Front of Sensor 5 = 0.050"

**Schematics**

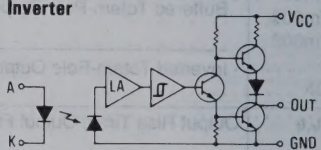
**OPB900/OPB910 (Totem-Pole Output) Buffer**



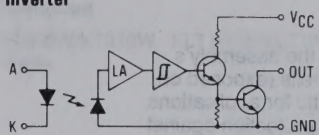

**OPB901/OPB911 (Open-Collector Output) Buffer**




**OPB902/OPB912 (Totem-Pole Output) Inverter**



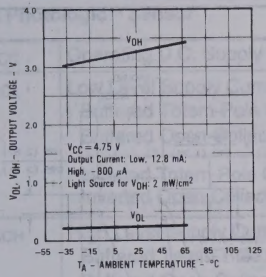

**OPB903/OPB913 (Open-Collector Output) Inverter**



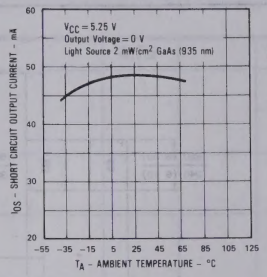
## Typical Performance Curves

### OPB900L, OPB902L, OPB910L, OPB912L

**Output Voltage vs Ambient Temperature**

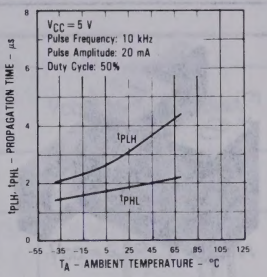

$V_{OH}$
$V_{OL}$
$V_{CC}$ = 4.75 V
Output Current: Low, 12.8 mA;
High, −800 μA
Light Source for $V_{OH}$: 2 mW/cm²
$V_{OL}$ - $V_{OH}$ - OUTPUT VOLTAGE - V
$T_A$ - AMBIENT TEMPERATURE - °C

**Short Circuit Output Current vs Ambient Temperature**



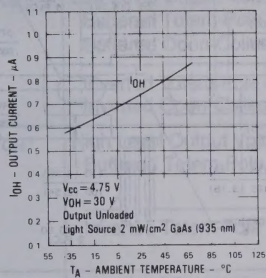

**All Assemblies**

**Propagation Time vs Ambient Temperature**

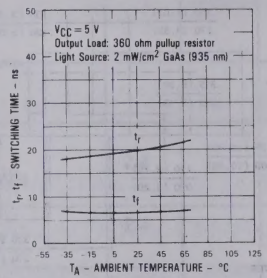



### OPB901L, OPB903L, OPB911L, OPB913L

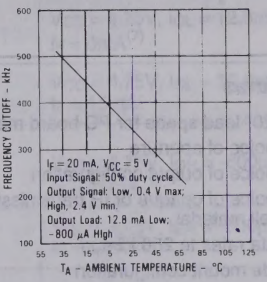
**Output Current (High) vs Ambient Temperature**




**Rise Time and Fall Time vs Ambient Temperature**

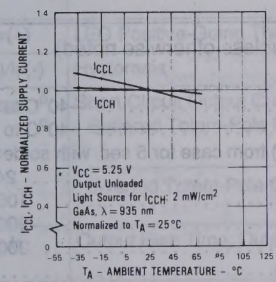

$V_{CC}$ = 5 V
Output Load: 360 ohm pullup resistor
Light Source: 2 mW/cm² GaAs (935 nm)
$t_r$
$t_f$
$t_r$, $t_f$ - SWITCHING TIME - ns
$T_A$ - AMBIENT TEMPERATURE - °C

**Data Rate vs Ambient Temperature**


$I_F$ = 20 mA, $V_{CC}$ = 5 V
Input Signal: 50% duty cycle
Output Signal: Low, 0.4 V max;
High, 2.4 V min.
Output Load: 12.8 mA Low;
−800 μA High
FREQUENCY CUTOFF - kHz
$T_A$ - AMBIENT TEMPERATURE - °C

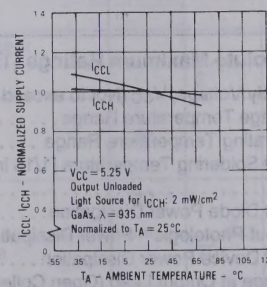
### OPB900L, OPB901L, OPB910L, OPB911L

**Normalized Supply Current vs Ambient Temperature**


$I_{CCL}$
$I_{CCH}$
$V_{CC}$ = 5.25 V
Output Unloaded
Light Source for $I_{CCH}$: 2 mW/cm²
GaAs, λ = 935 nm
Normalized to $T_A$ = 25°C
$I_{CCL}$, $I_{CCH}$ - NORMALIZED SUPPLY CURRENT
$T_A$ - AMBIENT TEMPERATURE - °C

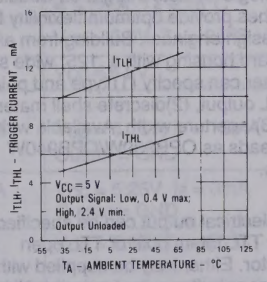
### OPB902L, OPB903L, OPB912L, OPB913L

**Normalized Supply Current vs Ambient Temperature**

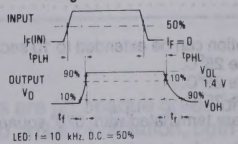

$I_{CCL}$
$I_{CCH}$
$V_{CC}$ = 5.25 V
Output Unloaded
Light Source for $I_{CCH}$: 2 mW/cm²
GaAs, λ = 935 nm
Normalized to $T_A$ = 25°C
$I_{CCL}$, $I_{CCH}$ - NORMALIZED SUPPLY CURRENT
$T_A$ - AMBIENT TEMPERATURE - °C

### All Assemblies

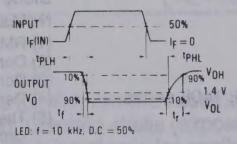
**Trigger Current vs Ambient Temperature**




**Switching Test Curve for Buffers**

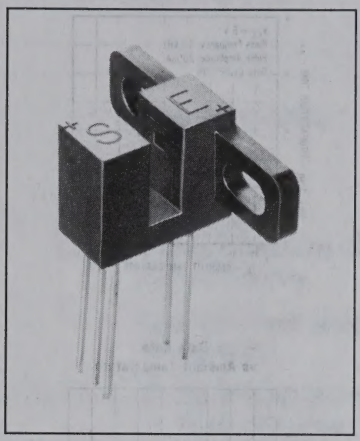


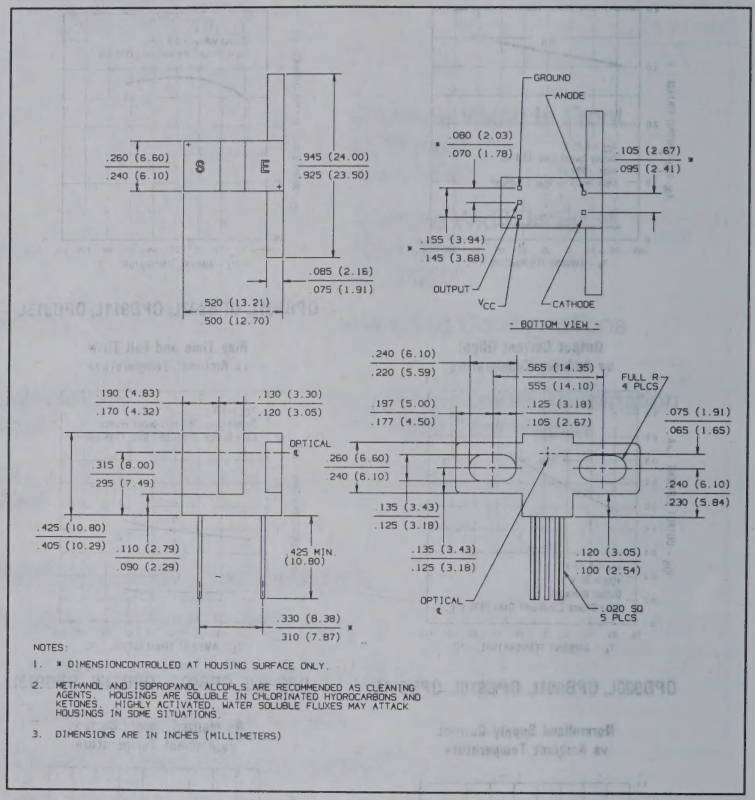

**Switching Test Curve for Inverters**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Photologic™ Slotted Optical Switches
## Types OPB930L, OPB940L Series






NOTES:
1. * DIMENSIONCONTROLLED AT HOUSING SURFACE ONLY.
2. METHANOL AND ISOPROPANOL ALCOHLS ARE RECOMMENDED AS CLEANING AGENTS. HOUSINGS ARE SOLUBLE IN CHLORINATED HYDROCARBONS AND KETONES. HIGHLY ACTIVATED, WATER SOLUBLE FLUXES MAY ATTACK HOUSINGS IN SOME SITUATIONS.
3. DIMENSIONS ARE IN INCHES (MILLIMETERS)

### Features

- .320" lead space for PC board mount
- Choice of aperture
- Choice of output configuration
- Choice of opaque or IR transmissive shell material
- Data rates to 250 kBaud
- Side mount configuration

### Description

The OPB930L and OPB940L series of Photologic™ Photo Integrated Circuit Switches provide optimum flexibility for the design engineer. Building from a standard housing with a .125" wide slot, the user can specify (1) type and polarity of TTL output, (2)discrete shell material, and (3) aperture width. Available with wire leads as OPB930W/OPB940W series.

The electrical output can be specified as either TTL totem pole or TTL open collector. Either may be supplied with inverter or buffer output polarity. All have added stability of a built-in hysteresis amplifier.

### Replaces

KT930L/940L, KLT130L/140L series

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (Not to exceed 3 sec.) | 10V |
| Storage Temperature Range | -40°C to +85°C |
| Operating Temperature Range | -40°C to +70°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |
| Input Diode Power Dissipation | 100mW(2) |
| Output Photologic™ Power Dissipation | 200mW(3) |
| Total Device Power Dissipation | 300mW(4) |
| Voltage at Output Lead (Open Collector Output) | 35V |
| Diode Forward D.C. Current | 40mA |
| Diode Reverse D.C. Voltage | 2V |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.22mW/°C above 25°C.
(3) Derate linearly 4.44mW/°C above 25°C.
(4) Derate linearly 6.66mW/°C above 25°C.
(5) The OPB930L/OPB940L series are terminated with .020" square leads designed for printed circuit board mounting.
(6) Methanol and isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(7) Normal application would be with light source blocked, simulated by $I_F$ = 0mA.
(8) All parameters tested using pulse technique.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB930L, OPB940L Series

**Electrical Characteristics** ($T_A$ = -40°C to +70°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20mA, $T_A$ = 25°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V, $T_A$ = 25°C |
| **Output Photologic™ Sensor** | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | 4.75 | | 5.25 | V | |
| $I_{CCL}$ | Low Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(7) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 15mA |
| $I_{CCH}$ | High Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 15mA |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(7) |
| $V_{OL}$ | Low Level Output Voltage:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 0mA(7) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 15mA |
| $V_{OH}$ | High Level Output Voltage:<br>Buffered Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75V, $I_{OH}$ = -800µA<br>$I_F$ = 15mA |
| | Inverted Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75V, $I_{OH}$ = -800µA<br>$I_F$ = 0mA(7) |
| $I_{OH}$ | High Level Output Current:<br>Buffered Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V<br>$I_F$ = 15mA, $T_A$ = 25°C |
| | Inverted Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V,<br>$I_F$ = 0mA, $T_A$ = 25°C |
| $I_F(+)$ | LED Positive-Going Threshold Current | | | 15 | mA | $V_{CC}$ = 5.0V, $T_A$ = 25°C |
| $I_F(+)/I_F(-)$ | Hysteresis | | 2 | | | $V_{CC}$ = 5.0V |
| $I_{OS}$ | Short Circuit Output Current:<br>Buffered Totem-Pole Output | -30 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 15mA<br>Output = GND |
| | Inverted Totem-Pole Output | -30 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA<br>Output = GND |
| $t_r$,$t_f$ | Output Rise Time, Output Fall Time | | 70 | | ns | $V_{CC}$ = 5.0V, $T_A$ = 25°C<br>$I_F$ = 0 or 15mA |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay Low-High & High-Low | | 5 | | µs | $R_L$ = 8TTL Loads (Totem Pole)<br>$R_L$ = 360Ω (Open Collector) |

## Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic for maximum protection against ambient light.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# PART NUMBER GUIDE

OPB 9 X X X X X

- Optek Assembly
- Photologic™ Photo Integrated Circuit Sensor Family
- Discrete Shell Material Designation
  - 3 - Side Mount IR Transmissive Plastic Discrete Shell
  - 4 - Side Mount Opaque Plastic Discrete Shell
- Aperture Width In Front of Sensor
  5 = 0.050" 1 = 0.010"
- Aperture Width In Front of Emitter
  5 = 0.050"
- Mounting Configurations
  - L - Solder Leads Termination
  - W - Wire Termination

Electrical Specification Variations

0 - Buffered Totem-Pole Output

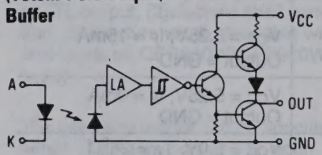
1 - Buffered Open-Collector Output

2 - Inverted Totem-Pole Output

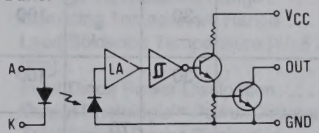
3 - Inverted Open-Collector Output

**Schematics**

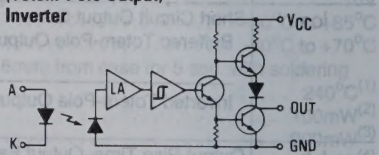
**OPB930, OPB940**
**(Totem-Pole Output)**
**Buffer**



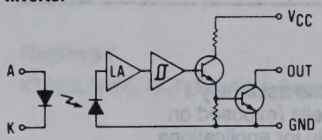

**OPB931, OPB941**
**(Open-Collector Output)**
**Buffer**




**OPB932, OPB942**
**(Totem-Pole Output)**
**Inverter**



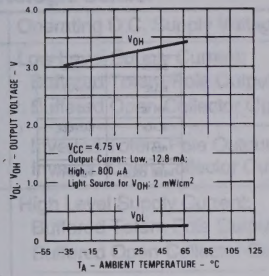

**OPB933, OPB943**
**(Open-Collector Output)**
**Inverter**



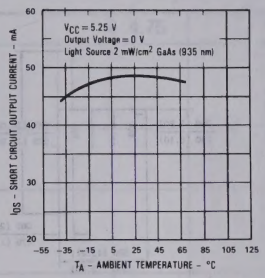
## Typical Performance Curves

### OPB930, OPB932, OPB940, OPB942

**Output Voltage vs Ambient Temperature**

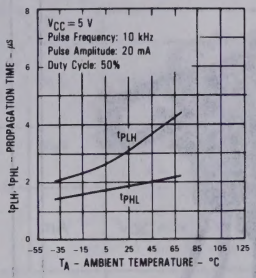

$V_{OH}$
$V_{OL}$
$V_{CC}$ = 4.75 V
Output Current: Low, 12.8 mA;
High, – 800 μA
Light Source for $V_{OH}$: 2 mW/cm²
$V_{OL}$, $V_{OH}$ – OUTPUT VOLTAGE – V
$T_A$ – AMBIENT TEMPERATURE – °C

**Short Circuit Output Current vs Ambient Temperature**



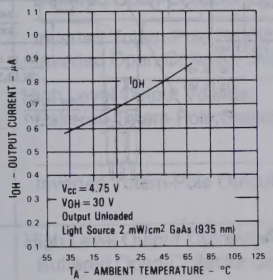

### All Assemblies

**Propagation Time vs Ambient Temperature**

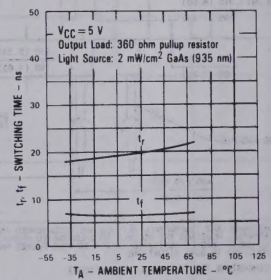



### OPB931, OPB933, OPB941, OPB943

**Output Current (High) vs Ambient Temperature**

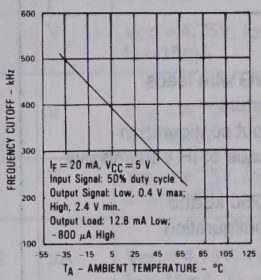



**Rise Time and Fall Time vs Ambient Temperature**


$V_{CC}$ = 5 V
Output Load: 360 ohm pullup resistor
Light Source: 2 mW/cm² GaAs (935 nm)
$t_r$
$t_f$
$t_r$, $t_f$ – SWITCHING TIME – ns
$T_A$ – AMBIENT TEMPERATURE – °C

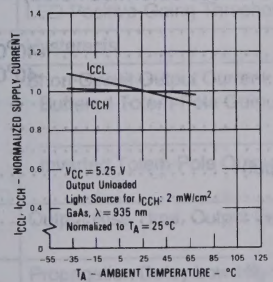
### All Assemblies

**Data Rate vs Ambient Temperature**


$I_F$ = 20 mA, $V_{CC}$ = 5 V
Input Signal: 50% duty cycle
Output Signal: Low, 0.4 V max;
High, 2.4 V min.
Output Load: 12.8 mA Low;
– 800 μA High
FREQUENCY CUTOFF – kHz
$T_A$ – AMBIENT TEMPERATURE – °C

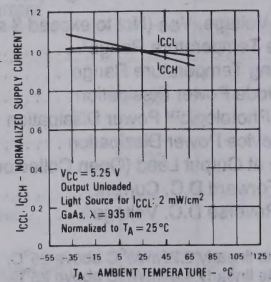
### OPB930, OPB931, OPB940, OPB941

**Normalized Supply Current vs Ambient Temperature**


$I_{CCL}$
$I_{CCH}$
$V_{CC}$ = 5.25 V
Output Unloaded
Light Source for $I_{CCH}$: 2 mW/cm²
GaAs, λ = 935 nm
Normalized to $T_A$ = 25°C
$I_{CCL}$, $I_{CCH}$ – NORMALIZED SUPPLY CURRENT
$T_A$ – AMBIENT TEMPERATURE – °C

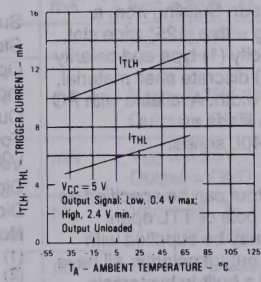
### OPB932, OPB933, OPB942, OPB943

**Normalized Supply Current vs Ambient Temperature**

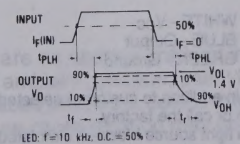

$I_{CCL}$
$I_{CCH}$
$V_{CC}$ = 5.25 V
Output Unloaded
Light Source for $I_{CCL}$: 2 mW/cm²
GaAs, λ = 935 nm
Normalized to $T_A$ = 25°C
$I_{CCL}$, $I_{CCH}$ – NORMALIZED SUPPLY CURRENT
$T_A$ – AMBIENT TEMPERATURE – °C

### All Assemblies

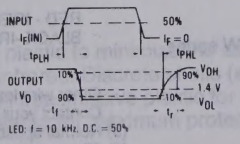
**Trigger Current vs Ambient Temperature**




**Switching Test Curve for Buffers**

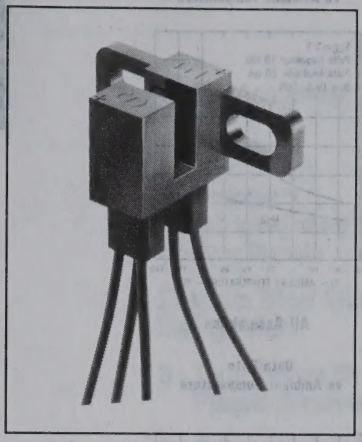


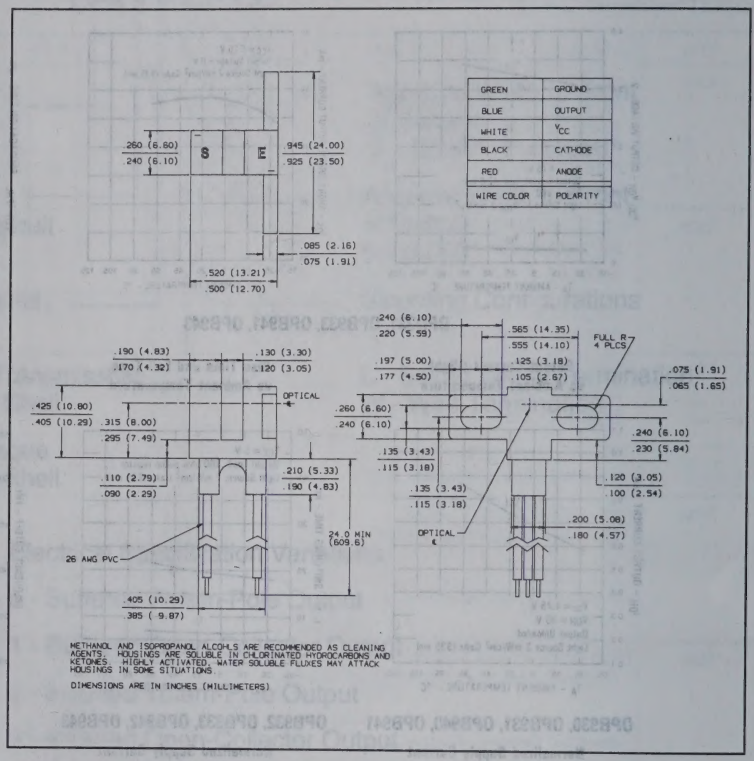

**Switching Test Curve for Inverters**




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Photologic™ Slotted Optical Switches
## Types OPB930W, OPB940W Series






### Features

- 24" min 26AWG wire leads
- Choice of aperture
- Choice of output configuration
- Choice of opaque or IR transmissive shell material
- Data rates to 250 kBaud
- Side mount configuration

### Description

The OPB930W and OPB940W series of Photologic™ Photo Integrated Circuit Switches provide optimum flexibility for the design engineer. Building from a standard housing with a .125" wide slot, the user can specify (1) type and polarity of TTL output, (2) discrete shell material, and (3) aperture width. Available with PC board mountable leads as OPB930L/OPB940L series.

The electrical output can be specified as either TTL totem pole or TTL open collector. Either may be supplied with inverter or buffer output polarity. All have added stability of a built-in hysteresis amplifier.

### Replaces

KT930W/940W, KLT130W/140W series

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (Not to exceed 3 sec.) | 10V |
| Storage Temperature Range | -40°C to +80°C |
| Operating Temperature Range | -40°C to +70°C |
| Input Diode Power Dissipation | 100mW(1) |
| Output Photologic™ Power Dissipation | 200mW(2) |
| Total Device Power Dissipation | 300mW(3) |
| Voltage at Output Lead (Open Collector Output) | 35V |
| Diode Forward D.C. Current | 40mA |
| Diode Reverse D.C. Voltage | 2V |

**Notes:**

(1) Derate linearly 2.22mW/°C above 25°C.
(2) Derate linearly 4.44mW/°C above 25°C.
(3) Derate linearly 6.66mW/°C above 25°C.
(4) The OPB930W/OPB940W series of switches are terminated with 24 inches of 7 strand 26 AWG, UL 1429 insulated wire on each terminal. Insulation colors and functions are:

| | |
|---|---|
| RED - IRED Anode | WHITE - $V_{CC}$ |
| BLACK -IRED Cathode | BLUE - Output |
| | GREEN - Ground |

Other wire lengths and/or colors in addition to customer selected connectors are available. Contact your local representative or call the factory.
(5) Normal application would be with light source blocked, simulated by $I_F$ = 0mA.
(6) All parameters tested using pulse technique.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB930W, OPB940W Series

**Electrical Characteristics** ($T_A$ = -40°C to +70°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20mA, $T_A$ = 25°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V, $T_A$ = 25°C |
| **Output Photologic Sensor** | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | 4.75 | | 5.25 | V | |
| $I_{CCL}$ | Low Level Supply Current: Buffered Totem-Pole Output, Buffered Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(5) |
| | Inverted Totem-Pole Output, Inverted Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 15mA |
| $I_{CCH}$ | High Level Supply Current: Buffered Totem-Pole Output, Buffered Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 15mA |
| | Inverted Totem-Pole Output, Inverted Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(5) |
| $V_{OL}$ | Low Level Output Voltage: Buffered Totem-Pole Output, Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA, $I_F$ = 0mA(5) |
| | Inverted Totem-Pole Output, Inverted Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA, $I_F$ = 15mA |
| $V_{OH}$ | High Level Output Voltage: Buffered Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75V, $I_{OH}$ = -800µA, $I_F$ = 15mA |
| | Inverted Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75V, $I_{OH}$ = -800µA, $I_F$ = 0mA(5) |
| $I_{OH}$ | High Level Output Current: Buffered Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V, $I_F$ = 15mA, $T_A$ = 25°C |
| | Inverted Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V, $I_F$ = 0mA, $T_A$ = 25°C |
| $I_{F(+)}$ | LED Positive-Going Threshold Current | | | 15 | mA | $V_{CC}$ = 5.0V, $T_A$ = 25°C |
| $I_{F(+)}/I_{F(-)}$ | Hysteresis | | 2.0 | | | $V_{CC}$ = 5.0V |
| $I_{OS}$ | Short Circuit Output Current: Buffered Totem-Pole Output | -30 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 15mA, Output = GND |
| | Inverted Totem-Pole Output | -30 | | -100 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA, Output = GND |
| $t_r, t_f$ | Output Rise Time, Output Fall Time | | 70 | | ns | $V_{CC}$ = 5V, $T_A$ = 25°C, $I_F$ = 0 or 15mA |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay Low-High & High-Low | | 5.0 | | µs | $R_L$ = 8TTL Loads (Totem Pole), $R_L$ = 360Ω (Open Collector) |

### Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic for maximum protection against ambient light.



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# PART NUMBER GUIDE

OPB 9 X X X X X

Optek Assembly

Photologic™
Photo Integrated Circuit
Sensor Family

Discrete Shell Material
Designation

3 - Side Mount IR Transmissive
Plastic Discrete Shell

4 - Side Mount Opaque
Plastic Discrete Shell

Aperture Width In Front
of Sensor
5 = 0.050" 1 = 0.010"

Aperture Width In Front
of Emitter
5 = 0.050"

Mounting Configurations

L - Solder Leads Termination
W - Wire Termination

Electrical Specification Variations

0 - Buffered Totem-Pole Output

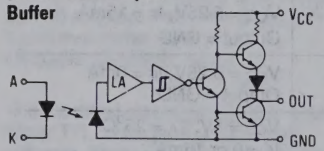
1 - Buffered Open-Collector Output

2 - Inverted Totem-Pole Output

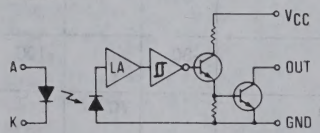
3 - Inverted Open-Collector Output

**Schematics**

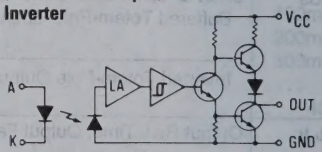
**OPB930, OPB940**
**(Totem-Pole Output)**
**Buffer**



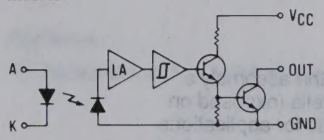

**OPB931, OPB941**
**(Open-Collector Output)**
**Buffer**




**OPB932, OPB942**
**(Totem-Pole Output)**
**Inverter**




**OPB933, OPB943**
**(Open-Collector Output)**
**Inverter**

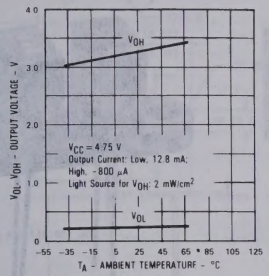


# Types OPB930W, OPB940W Series

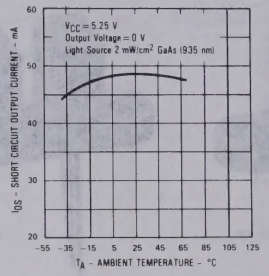
## Typical Performance Curves

### OPB930, OPB932, OPB940, OPB942

#### Output Voltage vs Ambient Temperature

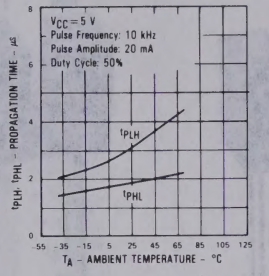

$V_{OH}$
$V_{CC}$ = 4.75 V
Output Current: Low, 12.8 mA;
High, −800 μA
Light Source for $V_{OH}$: 2 mW/cm²
$V_{OL}$
$V_{OL}$, $V_{OH}$ – OUTPUT VOLTAGE – V
$T_A$ – AMBIENT TEMPERATURE – °C

#### Short Circuit Output Current vs Ambient Temperature



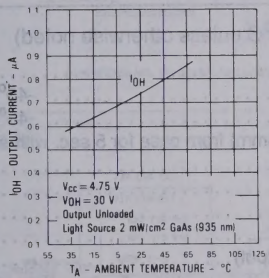

### All Assemblies

#### Propagation Time vs Ambient Temperature

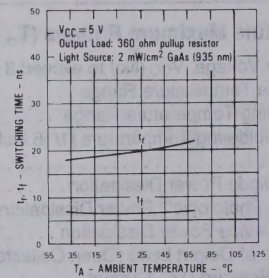



### OPB931, OPB933, OPB941, OPB943

#### Output Current (High) vs Ambient Temperature

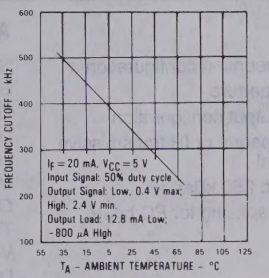



#### Rise Time and Fall Time vs Ambient Temperature


$V_{CC}$ = 5 V
Output Load: 360 ohm pullup resistor
Light Source: 2 mW/cm² GaAs (935 nm)
$t_r$
$t_f$
$t_r$, $t_f$ – SWITCHING TIME – ns
$T_A$ – AMBIENT TEMPERATURE – °C

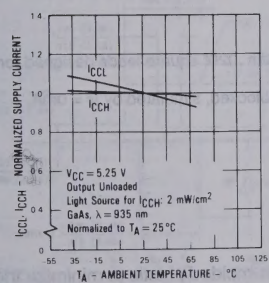
### All Assemblies

#### Data Rate vs Ambient Temperature


$I_F$ = 20 mA, $V_{CC}$ = 5 V
Input Signal: 50% duty cycle
Output Signal: Low, 0.4 V max;
High, 2.4 V min.
Output Load: 12.8 mA Low;
−800 μA High
FREQUENCY CUTOFF – kHz
$T_A$ – AMBIENT TEMPERATURE – °C

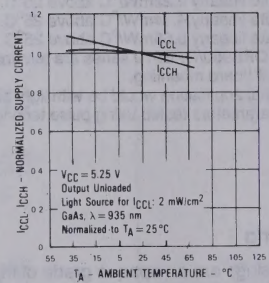
### OPB930, OPB931, OPB940, OPB941

#### Normalized Supply Current vs Ambient Temperature


$I_{CCL}$
$I_{CCH}$
$V_{CC}$ = 5.25 V
Output Unloaded
Light Source for $I_{CCH}$: 2 mW/cm²
GaAs, λ = 935 nm
Normalized to $T_A$ = 25°C
$I_{CCL}$, $I_{CCH}$ – NORMALIZED SUPPLY CURRENT
$T_A$ – AMBIENT TEMPERATURE – °C

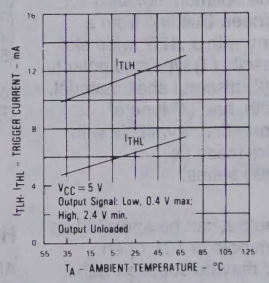
### OPB932, OPB933, OPB942, OPB943

#### Normalized Supply Current vs Ambient Temperature

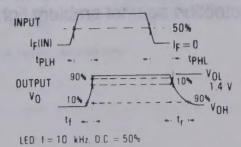

$I_{CCL}$
$I_{CCH}$
$V_{CC}$ = 5.25 V
Output Unloaded
Light Source for $I_{CCL}$: 2 mW/cm²
GaAs, λ = 935 nm
Normalized to $T_A$ = 25°C
$I_{CCL}$, $I_{CCH}$ – NORMALIZED SUPPLY CURRENT
$T_A$ – AMBIENT TEMPERATURE – °C

### All Assemblies

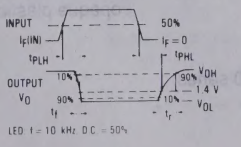
#### Trigger Current vs Ambient Temperature




#### Switching Test Curve for Buffers

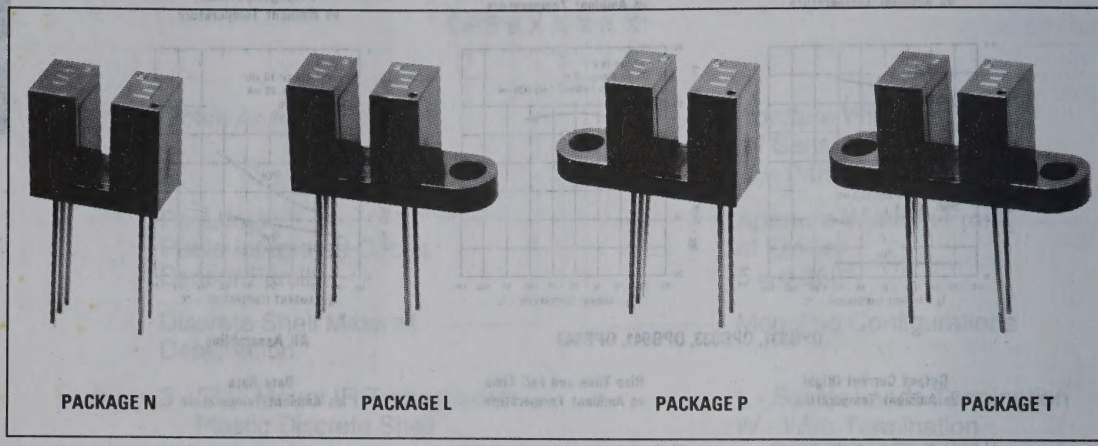



#### Switching Test Curve for Inverters




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Photologic™ Slotted Optical Switches
## Types OPB960, OPB970 Series



PACKAGE N PACKAGE L PACKAGE P PACKAGE T

### Features

- Choice of mounting configuration
- Choice of aperture
- Choice of output configuration
- Choice of opaque or IR transmissive shell material
- Data rates to 250 kBaud
- 0.320" lead spacing for PC board mount

### Description

The OPB960 and OPB970 series of Photologic™ Photo Integrated Circuit Switches provide optimum flexibility for the design engineer. Building from a standard housing with a .125" wide slot, the user can specify (1) type and polarity of TTL output, (2) discrete shell material, (3) aperture width, and (4) type of mounting configuration. Available with 24", 26AWG wire leads as OPB980/OPB990 series.

The electrical output can be specified as either TTL totem pole or TTL open collector. Either may be supplied with inverter or buffer output polarity. All have added stability of a built-in hysteresis amplifier.

### Replaces

KT960/970 series, KLT160/170 series. Upgrades OPB960/970 series.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (Not to exceed 3 sec.) | 10V |
| Storage Temperature Range | -40°C to +85°C |
| Operating Temperature Range | -40°C to +70°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |
| Input Diode Power Dissipation | 100mW(2) |
| Output Photologic™ Power Dissipation | 200mW(3) |
| Total Device Power Dissipation | 300mW(4) |
| Voltage at Output Lead (Open Collector Output) | 35V |
| Diode Forward D.C. Current | 40mA |
| Diode Reverse D.C. Voltage | 2V |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.22mW/°C above 25°C.
(3) Derate linearly 4.44mW/°C above 25°C.
(4) Derate linearly 6.66mW/°C above 25°C.
(5) The OPB960/OPB970 series are terminated with .020" square leads designed for printed circuit board mounting.
(6) Normal application would be with light source blocked, simulated by $I_F$ = 0mA.
(7) All parameters tested using pulse technique.

### Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic for maximum protection against ambient light.

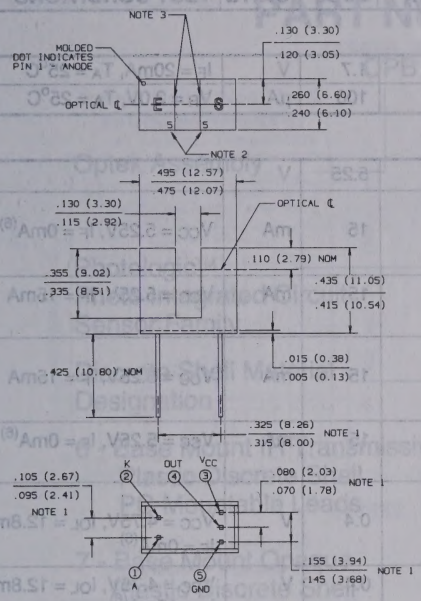
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Experience 32-Bit Power!

# Types OPB960, OPB970 Series

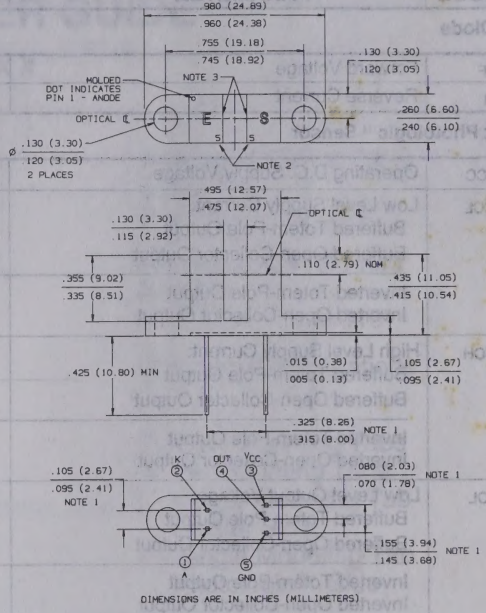


## Package N



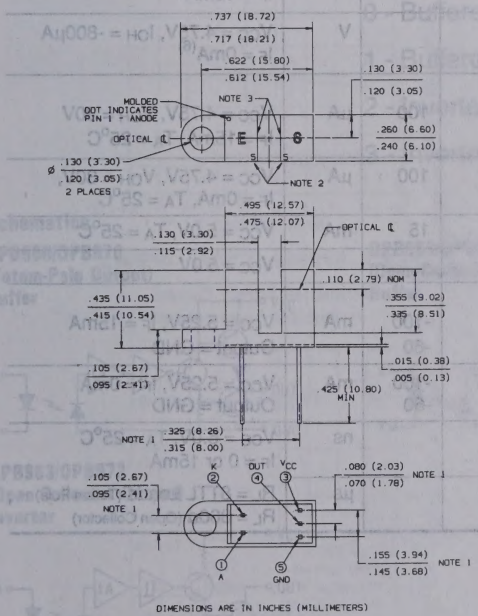

DIMENSIONS ARE IN INCHES (MILLIMETERS)

## Package T



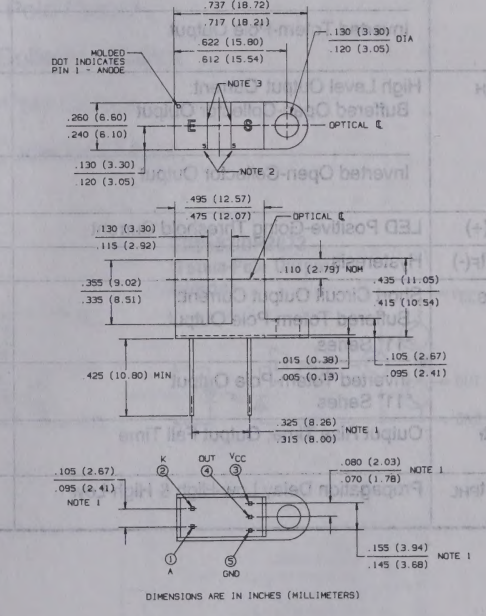

DIMENSIONS ARE IN INCHES (MILLIMETERS)

## Package L




DIMENSIONS ARE IN INCHES (MILLIMETERS)

## Package P




DIMENSIONS ARE IN INCHES (MILLIMETERS)

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

**Electrical Characteristics** ($T_A$ = -40°C to +70°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20mA, $T_A$ = 25°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V, $T_A$ = 25°C |
| **Output Photologic™ Sensor** | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | 4.75 | | 5.25 | V | |
| $I_{CCL}$ | Low Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(6) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 15mA |
| $I_{CCH}$ | High Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 15mA |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(6) |
| $V_{OL}$ | Low Level Output Voltage:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 0mA(6) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 15mA(6) |
| $V_{OH}$ | High Level Output Voltage:<br>Buffered Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75V, $I_{OH}$ = -800µA<br>$I_F$ = 15mA |
| | Inverted Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75V, $I_{OH}$ = -800µA<br>$I_F$ = 0mA(6) |
| $I_{OH}$ | High Level Output Current:<br>Buffered Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V<br>$I_F$ = 15mA, $T_A$ = 25°C |
| | Inverted Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V,<br>$I_F$ = 0mA, $T_A$ = 25°C |
| $I_{F(+)}$ | LED Positive-Going Threshold Current | | | 15 | mA | $V_{CC}$ = 5.0V, $T_A$ = 25°C |
| $I_{F(+)}/I_{F(-)}$ | Hysteresis | | 2.0 | | | $V_{CC}$ = 5.0V |
| $I_{OS}$ | Short Circuit Output Current:<br>Buffered Totem-Pole Output<br>"11" Series | -30<br>-15 | | -100<br>-60 | mA | $V_{CC}$ = 5.25V, $I_F$ = 15mA<br>Output = GND |
| | Inverted Totem-Pole Output<br>"11" Series | -30<br>-15 | | -100<br>-60 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA<br>Output = GND |
| $t_r$,$t_f$ | Output Rise Time, Output Fall Time | | 70 | | ns | $V_{CC}$ = 5.0V, $T_A$ = 25°C<br>$I_F$ = 0 or 15mA |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay Low-High & High-Low | | 5.0 | | µs | $R_L$ = 8TTL Loads (Totem Pole)<br>$R_L$ = 360Ω (Open Collector) |

# PART NUMBER GUIDE

OPB 9 X X X X X

Optek Assembly

Photologic™ Photo Integrated Circuit Sensor Family

Discrete Shell Material Designation

6 - Base Mount IR Transmissive Plastic Discrete Shell PC Mountable Leads

7 - Base Mount Opaque Plastic Discrete Shell PC Mountable Leads

Electrical Specification Variations

0 - Buffered Totem-Pole Output

1 - Buffered Open-Collector Output

2 - Inverted Totem-Pole Output

3 - Inverted Open-Collector Output

Mounting Configurations

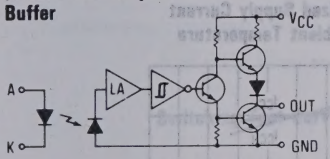
T - Both Mounting Tabs
N - No Mounting Tabs
L - Single Mounting Tab Emitter Side
P - Single Mounting Tab Photologic™ Side

Aperture Width In Front of Emitter
5 = 0.050" 1= 0.010"

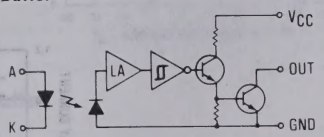
Aperture Width In Front of Sensor
5 = 0.050" 1= 0.010"

## Schematics

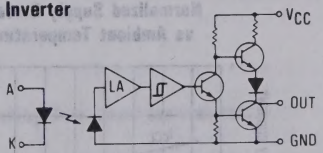
**OPB960/OPB970**
**(Totem-Pole Output)**
**Buffer**



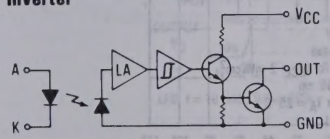

**OPB961/OPB971**
**(Open-Collector Output)**
**Buffer**




**OPB962/OPB972**
**(Totem-Pole Output)**
**Inverter**




**OPB963/OPB973**
**(Open-Collector Output)**
**Inverter**



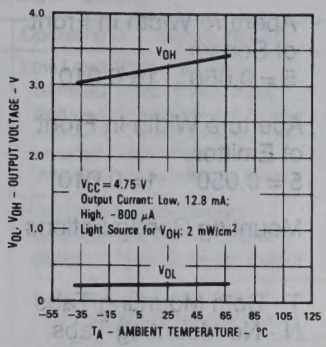

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

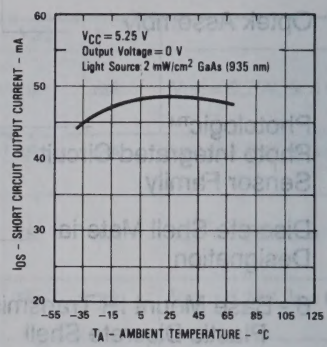
## Typical Performance Curves

### OPB960, OPB962, OPB970, OPB972

**Output Voltage vs Ambient Temperature**

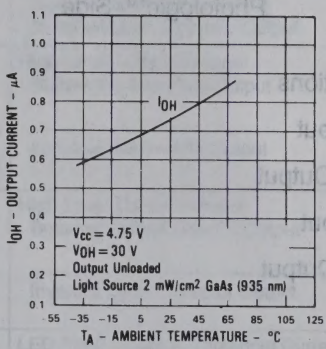



**Short Circuit Output Current vs Ambient Temperature**

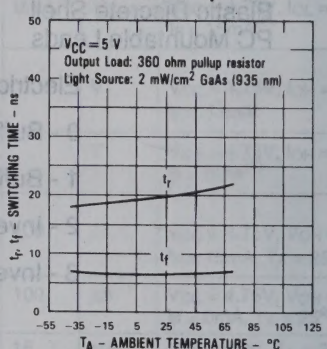

$V_{CC}$ = 5.25 V
Output Voltage = 0 V
Light Source 2 mW/cm² GaAs (935 nm)
$I_{OS}$ – SHORT CIRCUIT OUTPUT CURRENT – mA
60
50
40
30
20
−55 −35 −15 5 25 45 65 85 105 125
$T_A$ – AMBIENT TEMPERATURE – °C

### OPB961, OPB963, OPB971, OPB973

**Output Current (High) vs Ambient Temperature**

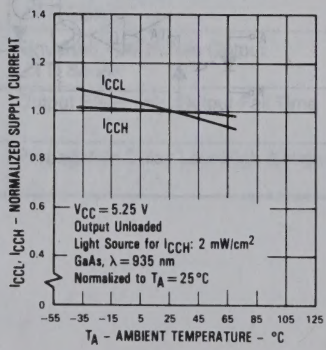



**Rise Time and Fall Time vs Ambient Temperature**



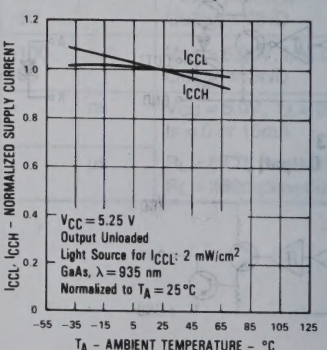

### OPB960, OPB961, OPB970, OPB971

**Normalized Supply Current vs Ambient Temperature**




### OPB962, OPB963, OPB972, OPB973

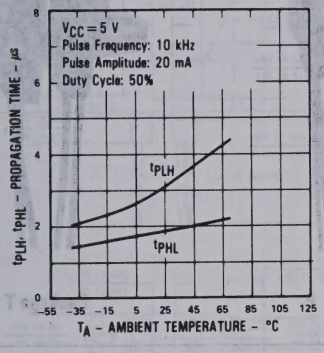
**Normalized Supply Current vs Ambient Temperature**



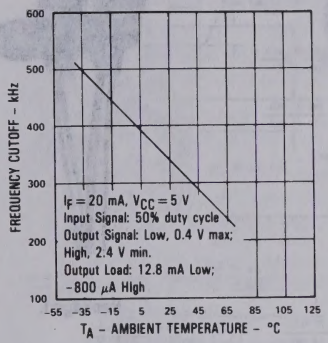
## Typical Performance Curves

### All Assemblies

**Propagation Time vs Ambient Temperature**

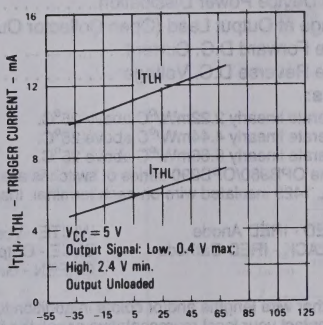



**Data Rate vs Ambient Temperature**

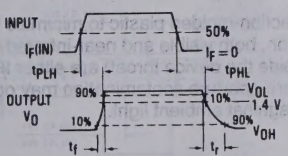

FREQUENCY CUTOFF – kHz
$I_F$ = 20 mA, $V_{CC}$ = 5 V
Input Signal: 50% duty cycle
Output Signal: Low, 0.4 V max;
High, 2.4 V min.
Output Load: 12.8 mA Low;
–800 µA High
$T_A$ – AMBIENT TEMPERATURE – °C

### All Assemblies

**Trigger Current vs Ambient Temperature**

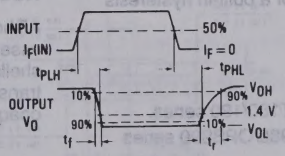



**Switching Test Curve for Buffers**



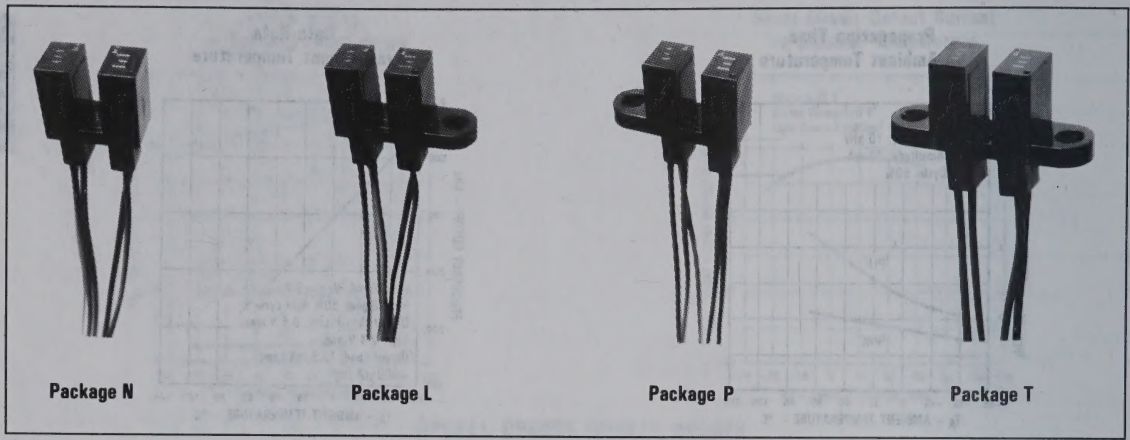

LED: f = 10 kHz, D.C. = 50%

**Switching Test Curve for Inverters**




LED: f = 10 kHz, D.C. = 50%

# Photologic™ Slotted Optical Switches
## Types OPB980, OPB990 Series



Package N | Package L | Package P | Package T

### Features

- Choice of mounting configuration
- Choice of aperture
- Choice of output configuration
- Choice of opaque or IR transmissive shell material
- Data rates to 250 kBaud
- 24" min 26AWG wire leads

### Description

The OPB980 and OPB990 series of Photologic™ Photo Integrated Circuit Switches provide optimum flexibility for the design engineer. Building from a standard housing with a .125" wide slot, the user can specify (1) type and polarity of TTL output, (2) discrete shell material, (3) aperture width, and (4) choice of mounting configuration.

The electrical output can be specified as either TTL totem pole or TTL open collector. Either may be supplied with inverter or buffer output polarity. All have added stability of a built-in hysteresis amplifier.

### Replaces

KT980/990, KLT180/190 series.
Upgrades OPB980/OPB990 series

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (Not to exceed 3 sec.) | 10V |
| Storage Temperature Range | -40°C to +80°C |
| Operating Temperature Range | -40°C to +70°C |
| Input Diode Power Dissipation | 100mW(1) |
| Output Photologic™ Power Dissipation | 200mW(2) |
| Total Device Power Dissipation | 300mW(3) |
| Voltage at Output Lead (Open Collector Output) | 35V |
| Diode Forward D.C. Current | 40mA |
| Diode Reverse D.C. Voltage | 2V |

**Notes:**
(1) Derate linearly 2.22mW/°C above 25°C.
(2) Derate linearly 4.44mW/°C above 25°C.
(3) Derate linearly 6.66mW/°C above 25°C.
(4) The OPB980/OPB990 series of switches are terminated with 24 inches of 7 strand 26 AWG, UL 1429 insulated wire on each terminal. Insulation colors and functions are:

| | |
|---|---|
| RED - IRED Anode | WHITE - $V_{CC}$ |
| BLACK - IRED Cathode | BLUE - Output |
| | GREEN - Ground |

Other wire lengths and/or colors in addition to customer selected connectors are available. Contact your local representative or call the factory.
(5) Normal application would be with light source blocked, simulated by $I_F$ = 0mA.
(6) All parameters tested using pulse techniques.

### Housing

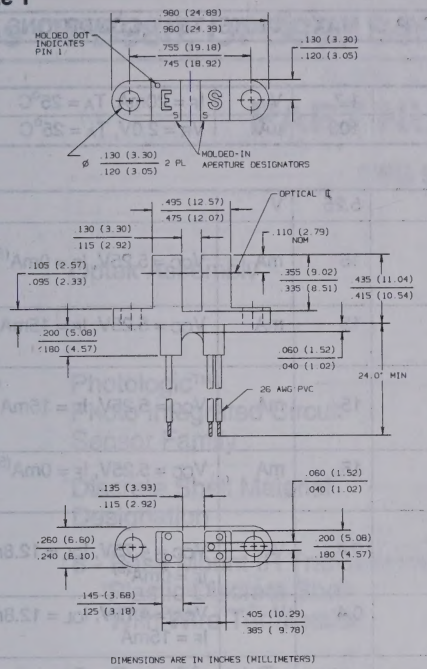
All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic for maximum protection against ambient light.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB980, OPB990 Series

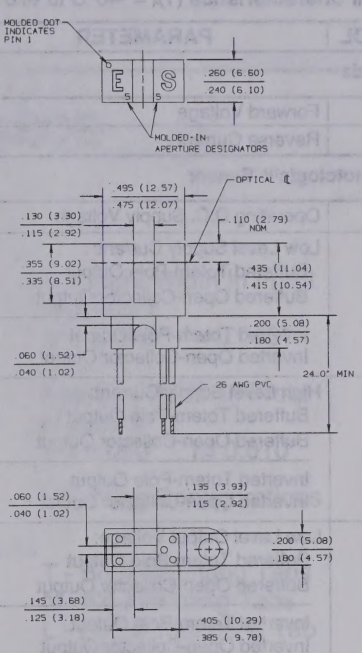


## Package T



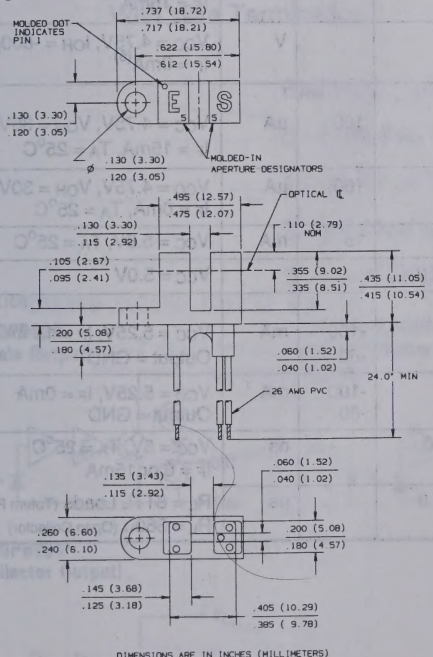

DIMENSIONS ARE IN INCHES (MILLIMETERS)

## Package N



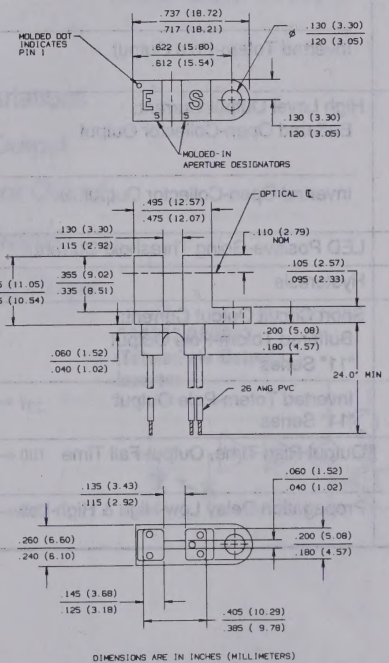

DIMENSIONS ARE IN INCHES (MILLIMETERS)

## Package L




DIMENSIONS ARE IN INCHES (MILLIMETERS)

## Package P




DIMENSIONS ARE IN INCHES (MILLIMETERS)

# Types OPB980, OPB990 Series

OPTEK

**Electrical Characteristics** ($T_A$ = -40°C to +70°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.7 | V | $I_F$ = 20mA, $T_A$ = 25°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V, $T_A$ = 25°C |
| **Output Photologic™ Sensor** | | | | | | |
| $V_{CC}$ | Operating D.C. Supply Voltage | 4.75 | | 5.25 | V | |
| $I_{CCL}$ | Low Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(5) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 15mA |
| $I_{CCH}$ | High Level Supply Current:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 15mA |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 15 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA(5) |
| $V_{OL}$ | Low Level Output Voltage:<br>Buffered Totem-Pole Output<br>Buffered Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 0mA(5) |
| | Inverted Totem-Pole Output<br>Inverted Open-Collector Output | | | 0.4 | V | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA<br>$I_F$ = 15mA |
| $V_{OH}$ | High Level Output Voltage:<br>Buffered Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75V, $I_{OH}$ = -800µA<br>$I_F$ = 15mA |
| | Inverted Totem-Pole Output | 2.4 | | | V | $V_{CC}$ = 4.75V, $I_{OH}$ = -800µA<br>$I_F$ = 0mA(5) |
| $I_{OH}$ | High Level Output Current:<br>Buffered Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V<br>$I_F$ = 15mA, $T_A$ = 25°C |
| | Inverted Open-Collector Output | | | 100 | µA | $V_{CC}$ = 4.75V, $V_{OH}$ = 30V,<br>$I_F$ = 0mA, $T_A$ = 25°C |
| $I_F(+)$ | LED Positive-Going Threshold Current | | | 15 | mA | $V_{CC}$ = 5.0V, $T_A$ = 25°C |
| $I_F(+)/I_F(-)$ | Hysteresis | | 2.0 | | | $V_{CC}$ = 5.0V |
| $I_{OS}$ | Short Circuit Output Current:<br>Buffered Totem-Pole Output<br>"11" Series | -30<br>-15 | | -100<br>-60 | mA | $V_{CC}$ = 5.25V, $I_F$ = 15mA<br>Output = GND |
| | Inverted Totem-Pole Output<br>"11" Series | -30<br>-15 | | -100<br>-60 | mA | $V_{CC}$ = 5.25V, $I_F$ = 0mA<br>Output = GND |
| $t_r$,$t_f$ | Output Rise Time, Output Fall Time | | 70 | | ns | $V_{CC}$ = 5V, $T_A$ = 25°C<br>$I_F$ = 0 or 15mA |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay Low-High & High-Low | | 5.0 | | µs | $R_L$ = 8TTL Loads (Totem Pole)<br>$R_L$ = 360Ω (Open Collector) |

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# PART NUMBER GUIDE

OPB 9 X X X X X

Optek Assembly

Photologic™ Photo Integrated Circuit Sensor Family

Discrete Shell Material Designation

8 - Base Mount IR Transmissive Plastic Discrete Shell With Wire Termination

9 - Base Mount Opaque Plastic Discrete Shell With Wire Termination

Aperture Width In Front of Sensor
5 = 0.050" 1= 0.010"

Aperture Width In Front of Emitter
5 = 0.050" 1= 0.010"

Mounting Configurations

T - Both Mounting Tabs
N - No Mounting Tabs
L - Single Mounting Tab Emitter Side
P - Single Mounting Tab Photologic™ Side

Electrical Specification Variations

0 - Buffered Totem-Pole Output

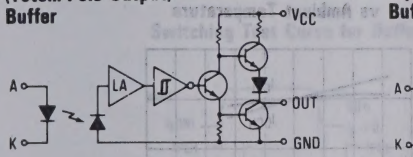
1 - Buffered Open-Collector Output

2 - Inverted Totem-Pole Output

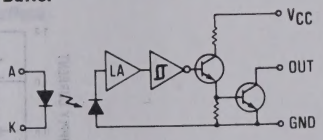
3 - Inverted Open-Collector Output

**Schematics**

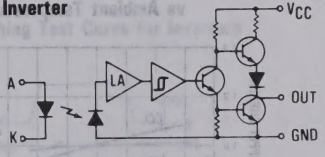
**OPB980/OPB990**
**(Totem-Pole Output)**
**Buffer**



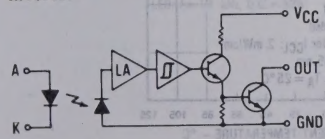

**OPB981/OPB991**
**(Open-Collector Output)**
**Buffer**




**OPB982/OPB992**
**(Totem-Pole Output)**
**Inverter**




**OPB983/OPB993**
**(Open-Collector Output)**
**Inverter**



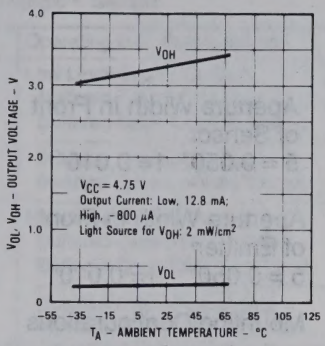

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

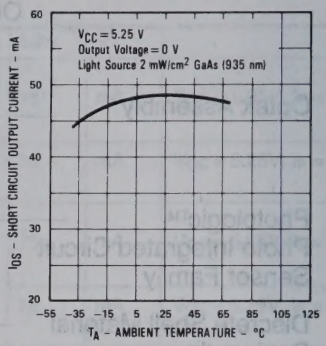
## Typical Performance Curves

### OPB980, OPB982, OPB990, OPB992

**Output Voltage vs Ambient Temperature**

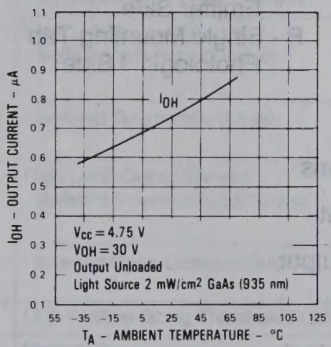

$V_{OH}$
$V_{OL}$
$V_{CC}$ = 4.75 V
Output Current: Low, 12.8 mA;
High, −800 μA
Light Source for $V_{OH}$: 2 mW/cm²
$V_{OL}$, $V_{OH}$ – OUTPUT VOLTAGE – V
$T_A$ – AMBIENT TEMPERATURE – °C

**Short Circuit Output Current vs Ambient Temperature**

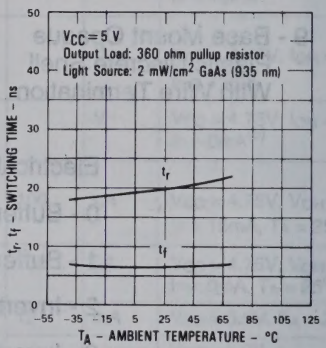



### OPB981, OPB983, OPB991, OPB993

**Output Current (High) vs Ambient Temperature**

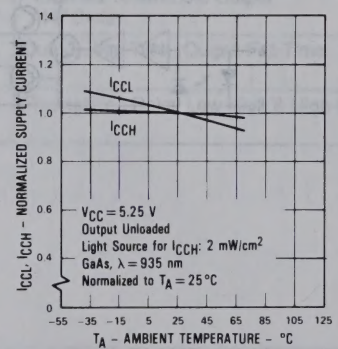



**Rise Time and Fall Time vs Ambient Temperature**


$V_{CC}$ = 5 V
Output Load: 360 ohm pullup resistor
Light Source: 2 mW/cm² GaAs (935 nm)
$t_r$
$t_f$
$t_r$, $t_f$ – SWITCHING TIME – ns
$T_A$ – AMBIENT TEMPERATURE – °C

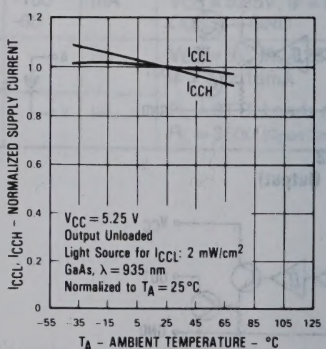
### OPB980, OPB981, OPB990, OPB991

**Normalized Supply Current vs Ambient Temperature**


$I_{CCL}$
$I_{CCH}$
$V_{CC}$ = 5.25 V
Output Unloaded
Light Source for $I_{CCH}$: 2 mW/cm²
GaAs, λ = 935 nm
Normalized to $T_A$ = 25°C
$I_{CCL}$, $I_{CCH}$ – NORMALIZED SUPPLY CURRENT
$T_A$ – AMBIENT TEMPERATURE – °C

### OPB982, OPB983, OPB992, OPB993

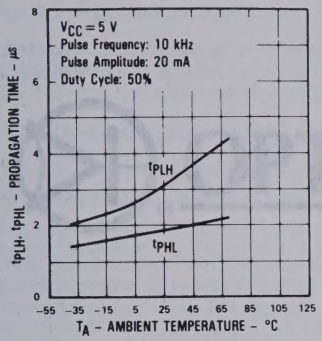
**Normalized Supply Current vs Ambient Temperature**


$I_{CCL}$
$I_{CCH}$
$V_{CC}$ = 5.25 V
Output Unloaded
Light Source for $I_{CCL}$: 2 mW/cm²
GaAs, λ = 935 nm
Normalized to $T_A$ = 25°C
$I_{CCL}$, $I_{CCH}$ – NORMALIZED SUPPLY CURRENT
$T_A$ – AMBIENT TEMPERATURE – °C

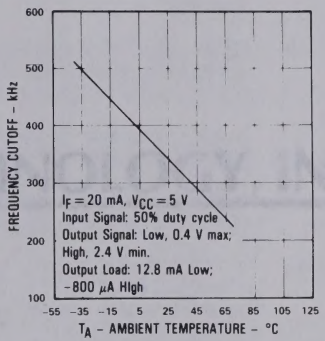
## Typical Performance Curves

### All Assemblies

**Propagation Time vs Ambient Temperature**

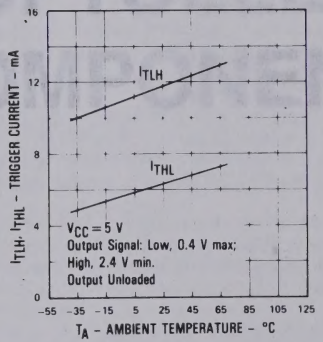



**Data Rate vs Ambient Temperature**

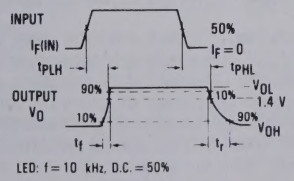

$I_F$ = 20 mA, $V_{CC}$ = 5 V
Input Signal: 50% duty cycle
Output Signal: Low, 0.4 V max;
High, 2.4 V min.
Output Load: 12.8 mA Low;
–800 µA High
FREQUENCY CUTOFF – kHz
$T_A$ – AMBIENT TEMPERATURE – °C

### All Assemblies

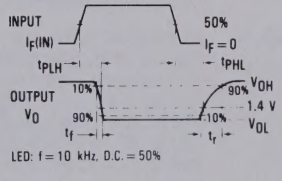
**Trigger Current vs Ambient Temperature**

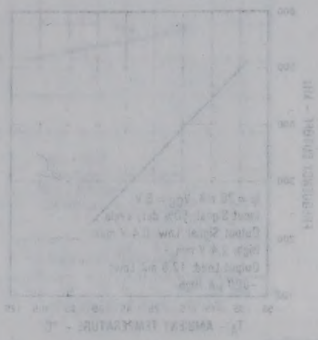


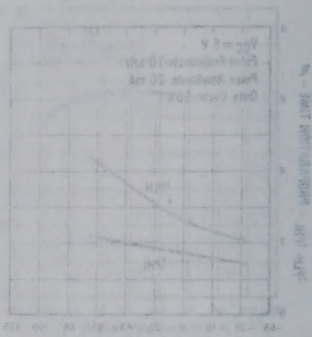

**Switching Test Curve for Buffers**

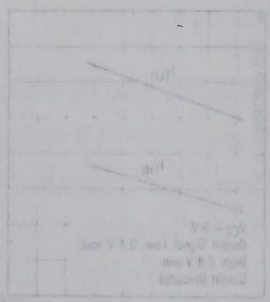


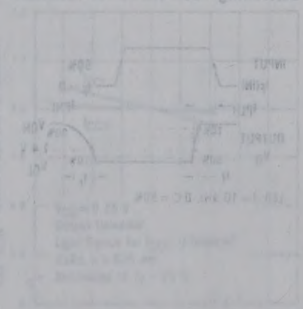

**Switching Test Curve for Inverters**

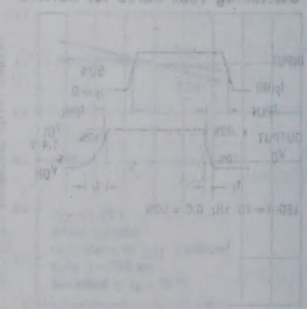












OPTEK TECHNOLOGY, INC.

# HI-REL OPTOELECTRONIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# High-Reliability Optoelectronic Devices

High-reliability requirements demand that products be able to function under abnormally severe levels of mechanical, environmental, and electrical stress. This challenge has been met by Optek with product designs and process control techniques that ensure high reliability and, thus, long life.

**Capabilities**

Optek maintains a well equipped high-reliability lab for conducting electrical, mechanical, and environmental tests. All testing is performed in-house, with engineering, manufacturing, and quality control facilities located within the continental United States.

Optek's calibration system complies with the requirements of MIL-45662, which incorporates both MIL-Q-9858 and MIL-1-45208.

High reliability optoelectronic devices from Optek are currently in use in a wide variety of space and defense programs.

**Certifications**

Optek is an QPL supplier, approved by D.E.S.C. to provide products in accordance with Military Specification MIL-S-19500. Electrical, environmental, and mechanical testing is done by experienced Optek employees based on MIL-STD-750 and MIL-STD-883 test methods and procedures. Military screening to as high as JANTXV is performed.

Optek has certified technicians in many areas such as x-ray and soldering. Any internal soldering, if required, is done in compliance with MIL-S-45743/WS6536.

**High-Reliability Couplers**

Optek's offering of high-reliability, optically coupled isolators consist of D.E.S.C. qualified devices to MIL-S-19500/486 and components processed to Optek's own military screening program. The 4N22A through 4N24A, and 4N47 through 4N49 series (pending) of D.E.S.C. qualified couplers are processed to JAN, JANTX, and JANTXV reliability levels per MIL-S-19500/486. (See Figure 1 for details.)

Although the 3N243TX through 3N245TX series of optically isolators are not military qualified, they are processed to Optek's own military screening program. Each device in the series receives process conditioning which includes a 160-hour power burn-in.

**High-Reliability Sensors and Emitters**

A large selection of discrete emitters and sensors are offered that are processed to Optek's own military screening program patterned after MIL-S19500. These devices are identified by "TX" and "TXV" suffixes. Although not military qualified devices, they receive 100% screening that parallels JANTX and JANTXV reliability requirements. (See Figure 2.)

For discrete sensors, the 100% screening includes both a 48-hour, high temperature reverse bias at $T_A = 125^oC$, and a 160-hour power burn-in at ambient temperature ($T_A = 25^oC$). For emitters, the 100% screening includes a burn-in in the forward direction for 96 or 160 hours, depending on the series.

One of the key advantages of purchasing part types to an in-house high-reliability screening program is that Group B and C lot charges may be avoided, since the manufacturer frequently spreads these costs over large groups of orders. For high-reliability emitters and sensors with "TX" and "TXV" suffixes, generic Group B and C data can be supplied with each order. Customers requiring Group B and C testing on their individual orders can also be accommodated, but these orders have to be run under special part numbers for control purposes.

**High-Reliability Assemblies**

In addition to the standard discrete optoelectronic components, Optek manufactures a wide variety of standard (off-the-shelf) and custom (built-to-print) assemblies. Most assemblies can be classified into one of two groups: slotted optical switches or reflective assemblies. Slotted optical switches are designed to provide non-contact sensing of linear or rotary motion. Reflective assemblies, in turn, are designed to provide non-contact sensing of reflective surfaces, or a change in surface reflectivity of an object. Both slotted optical switches and reflective assemblies can be purchased to high-reliability requirements.

High reliability assemblies are generally made with plastic housings and hermetically sealed discrete sensors and emitters. Before being placed in the housing, the discrete components are subjected to high-reliability processing. Frequently, this processing on the discrete devices is similar to what is specified on the individual high-reliability sensor and emitter data sheets.

## Custom Prints

Sometimes, it is necessary to have special electrical selections, screening requirements, or package configurations that are different from the standard offerings shown in the data sheets. Optek's custom capability is enormous. Assembly and test areas were designed with a great deal of flexibility, which allows the product to be built and tested on an order-to-order basis. The Quality Control Department's environmental testing areas are set up similarly, allowing many orders to be handled, each requiring different tests, screens, and conditions.

## Definitions of Common Reliability Terms

**Group A:** Consists of electrical tests and external visual inspection done on a sample basis by Q.C. At Optek, prior to submittal to Q.C. for Group A inspection, all devices in the lot are 100% electrically tested in manufacturing.

**Group B:** Consists of tests conducted on a sample basis to verify production lot conformance to package integrity, environmental extremes, and long-term reliability. The Group B samples are normally selected from lots that are manufactured within a six week time period, based on the date of final package sealing.

**Group C:** Is further environmental testing-similar to Group B, but sample testing is performed on a periodic basis (typically at six month intervals).

**Hi-Rel Processing, 100% Processing, TX Processing:** Same as Processing Conditioning.

**High Temperature Reverse Bias (HTRB):** Devices are reverse biased in a non-conduction mode at a high temperature for a period of time in this test. This test is used primarily to screen out those devices with inferior semiconductor die characteristics, such as poor voltage breakdown or leakage current. Ambient temperature is usually specified somewhere between +100°C to +175°C.

**JANTX:** All JANTX units receive process conditioning prior to quality conformance inspection. (See Figure 1)

**JANTXV:** Same as JANTX, plus 100% internal visual inspection. (See Figure 1)

**JANS:** An ultra-high-reliability version of JAN devices with very strict quality assurance and manufacturing controls imposed. JANS was designed with space applications in mind, and is the highest product assurance reliability level.

**MIL-S-19500:** Military document that establishes the general requirements for semiconductor devices for JAN, JANTX, JANTXV, and JANS reliability levels. Specific part type requirements and characteristics are specified in detail specifications for a particular series (e.g., 4N22A military series is spelled out in MIL-S-19500/486).

**MIL-STD-750:** Military specification that depicts electrical, mechanical, and environmental test procedures and methods for discrete semiconductors.

**Operating Life:** Also known as burn-in, life testing, and power age. Operating the device in a conduction mode (turned on) to simulate what the part will encounter in actual service. As a very common test in process conditioning, operating life is used to screen out those parts with potential short service life.

**Process Conditioning:** Tests (sometimes referred to as screens) that are performed on 100% of the devices in the lot to assure long-term reliability characteristics. (See Figure 2.)

**Qualification (Qual):** All testing performed to qualify a new part, traditionally consisting of Groups A, B, and C. Individual tests or requirements are sometimes added or deleted for qualification.

**Qualified Products List (QPL):** Semiconductor device types that are qualified under military specification MIL-S-19500 for JANTX, JANTXV, and JANS procurements.

**Quality Conformance Inspection:** Those tests performed to verify a given lot's conformance to a military document or a customer's specification. Quality conformance inspection consists of Group A, but may include Group B or C, depending on the requirements for the formulation of these groups of tests.

**Figure 1. Simplified JAN Product Flow**

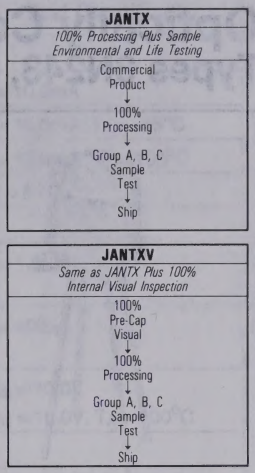
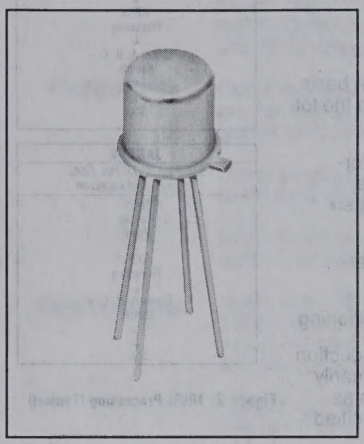
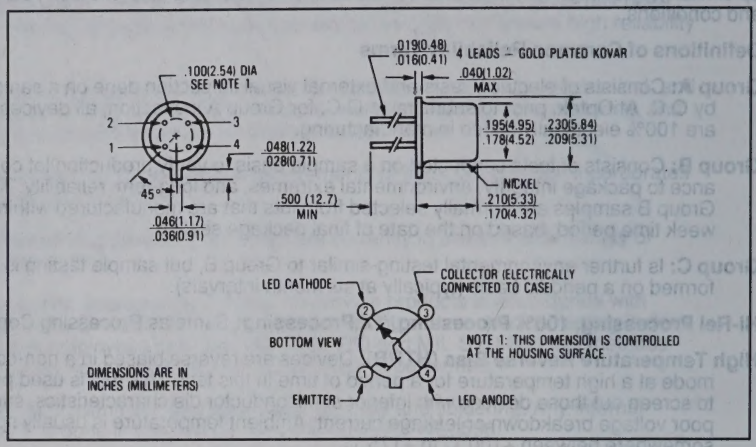



**Figure 2. 100% Processing (Typical)**

| |
|---|
| Pre-Cap Visual |
| High Temperature Storage |
| Temperature Cycle |
| Constant Acceleration |
| Hermetic Seal Fine: Gross: |
| High Temperature Reverse Bias |
| Power Burn-in |

# Optically Coupled Isolators
## Types 3N243, 3N244, 3N245






### Features

- TO-72 hermetically sealed package
- 1 kVDC electrical isolation
- TX-TXV process available (see Hi-Rel section)

### Description

The 3N243, 3N244, and 3N245 are JEDEC registered optically coupled isolators each consisting of an infrared emitting diode and an NPN silicon phototransistor mounted in a hermetically sealed TO-72 package.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ± 1.00kVDC(1) |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |
| **Input Diode** | |
| Forward DC Current | 40mA |
| Reverse Voltage | 2.0V |
| Power Dissipation | 60mW(3) |
| **Output Phototransistor** | |
| Continuous Collector Current | 30mA |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 200mW(4) |

**Notes:**
(1) Measured with input leads shorted together and output leads shorted together.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.6mW/°C above 25°C.
(4) Derate linearly 2.0mW/°C above 25°C.
(5) The input waveform is supplied by a generator with the following characteristics: $Z_{OUT}$ = 50Ω, tr ≤ 15ns, duty cycle ≅ 1%.

# Types 3N243, 3N244, 3N245

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

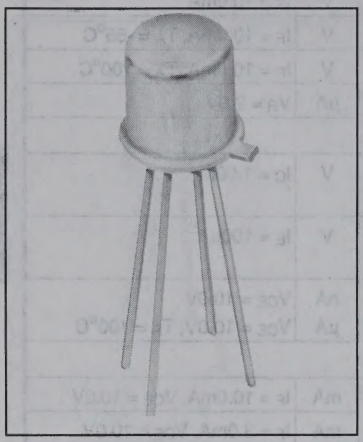
| Symbol | Parameter | 3N243 | | | 3N244 | | | 3N245 | | | Unit | Test Conditions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | | |
| **Input Diode** | | | | | | | | | | | | |
| $V_F$ | Forward Voltage | 0.80 | | 1.30 | 0.80 | | 1.30 | 0.80 | | 1.30 | V | $I_F = 10.0mA$ |
| | | 1.00 | | 1.50 | 1.00 | | 1.50 | 1.00 | | 1.50 | V | $I_F = 10.0mA, T_A = -55^oC$ |
| | | 0.70 | | 1.20 | 0.70 | | 1.20 | 0.70 | | 1.20 | V | $I_F = 10.0mA, T_A = 100^oC$ |
| $I_R$ | Reverse Current | | | 100 | | | 100 | | | 100 | µA | $V_R = 2.0V$ |
| **Output Phototransistor** | | | | | | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | | 30 | | | 30 | | | V | $I_C = 1.00mA$ |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | | 5.0 | | | 5.0 | | | V | $I_E = 100µA$ |
| $I_{CEO}$ | Collector Dark Current | | | 100 | | | 100 | | | 100 | nA | $V_{CE} = 10.0V$ |
| | | | | 100 | | | 100 | | | 100 | µA | $V_{CE} = 10.0V, T_A = 100^oC$ |
| **Coupled** | | | | | | | | | | | | |
| $I_{C(on)}$ | On-State Collector Current | 1.50 | | | 3.0 | | | 6.0 | | | mA | $I_F = 10.0mA, V_{CE} = 10.0V$ |
| | | 0.30 | | | 0.80 | | | 1.50 | | | mA | $I_F = 3.0mA, V_{CE} = 10.0V$ |
| | | 0.50 | | | 1.00 | | | 1.50 | | | mA | $I_F = 10.0mA, V_{CE} = 10.0V, T_A = -55^oC$ |
| | | 0.50 | | | 1.00 | | | 1.50 | | | mA | $I_F = 10.0mA, V_{CE} = 10.0V, T_A = 100^oC$ |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 0.30 | | | | | | | V | $I_F = 20mA, I_C = 1.50mA$ |
| | | | | | | | 0.30 | | | | V | $I_F = 20mA, I_C = 3.0mA$ |
| | | | | | | | | | | 0.30 | V | $I_F = 20mA, I_C = 6.0mA$ |
| $I_{IO}$ | Leakage Input-to-Output | | | 100 | | | 100 | | | 100 | nA | $V_{IO} = \pm 1.00kVDC$ (1) |
| $C_{IO}$ | Capacitance Input-to-Output | | | 5.0 | | | 5.0 | | | 5.0 | pF | $V_{IO} = 0V, f = 1.00MHz$ (1) |
| $t_r$ | Output Rise Time | | | 10.0 | | | 10.0 | | | 10.0 | µs | $V_{CC} = 10.0V, I_F = 10.0mA$, (5) |
| $t_f$ | Output Fall Time | | | 10.0 | | | 10.0 | | | 10.0 | µs | $R_L = 100\Omega$ |

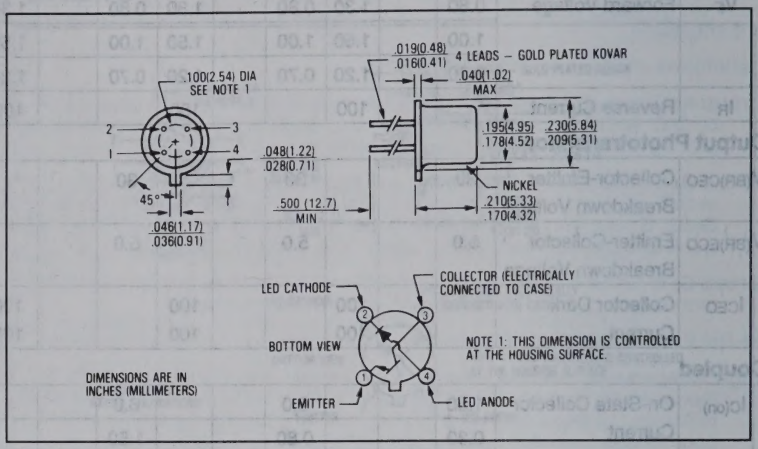


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# High Reliability Optically Coupled Isolators
## Types 3N243TX, 3N244TX, 3N245TX






### Features

- High-Reliability processed to Optek's military screening program patterned after MIL-S-19500
- TO-72 hermetically sealed package
- 1 kVDC electrical isolation

### Description

Each device in the series is a high reliability optically coupled isolator consisting of an infrared emitting diode and an NPN silicon phototransistor mounted in a hermetically sealed TO-72 package.

This series is identical to the JEDEC registered optically coupled isolators 3N243, 3N244, and 3N245 with additional high-reliability processing. This processing is patterned after MIL-S-19500 as shown in the accompanying table.

### Replaces

3N243R, 3N244R, 3N245R

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ± 1.00kVDC(1) |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |
| **Input Diode** | |
| Forward DC Current | 40mA |
| Reverse Voltage | 2.0V |
| Power Dissipation | 60mW(3) |
| **Output Phototransistor** | |
| Continuous Collector Current | 30mA |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 200mW(4) |

**Notes:**
(1) Measured with input leads shorted together and output leads shorted together.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.60mW/°C above 65°C.
(4) Derate linearly 2.0mW/°C above 25°C.
(5) The input waveform is supplied by a generator with the following characteristics: $Z_{OUT}$ = 50Ω, tr ≤ 15ns, duty cycle ≅ 1%, pulse width ≅ 100μs.

# Types 3N243TX, 3N244TX, 3N245TX

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | 3N243TX | | | 3N244TX | | | 3N245TX | | | Unit | Test Conditions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | | |
| **Input Diode** | | | | | | | | | | | | |
| $V_F$ | Forward Voltage | 0.80 | | 1.30 | 0.80 | | 1.30 | 0.80 | | 1.30 | V | $I_F$ = 10.0mA |
| | | 1.00 | | 1.50 | 1.00 | | 1.50 | 1.00 | | 1.50 | V | $I_F$ = 10.0mA, $T_A$ = -55°C |
| | | 0.70 | | 1.20 | 0.70 | | 1.20 | 0.70 | | 1.20 | V | $I_F$ = 10.0mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | | 100 | | | 100 | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | | 30 | | | 30 | | | V | $I_C$ = 1.00mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | | 5.0 | | | 5.0 | | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector Dark Current | | | 100<br>100 | | | 100<br>100 | | | 100<br>100 | nA<br>µA | $V_{CE}$ = 10.0V<br>$V_{CE}$ = 10.0V, $T_A$ = 100°C |
| **Coupled** | | | | | | | | | | | | |
| $I_{C(on)}$ | On-State Collector Current | 1.50 | | | 3.00 | | | 6.00 | | | mA | $I_F$ = 10.0mA, $V_{CE}$ = 10.0V |
| | | 0.30 | | | 0.80 | | | 1.50 | | | mA | $I_F$ = 3.0mA, $V_{CE}$ = 10.0V |
| | | 0.50 | | | 1.00 | | | 1.50 | | | mA | $I_F$ = 10.0mA, $V_{CE}$ = 10.0V, $T_A$ = -55°C |
| | | 0.50 | | | 1.00 | | | 1.50 | | | mA | $I_F$ = 10.0mA, $V_{CE}$ = 10.0V, $T_A$ = 100°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 0.30 | | | | | | | V | $I_F$ = 20mA, $I_C$ = 1.50mA |
| | | | | | | | 0.30 | | | | V | $I_F$ = 20mA, $I_C$ = 3.0mA |
| | | | | | | | | | | 0.30 | V | $I_F$ = 20mA, $I_C$ = 6.0mA |
| $i_{IO}$ | Leakage Input-to-Output | | | 100 | | | 100 | | | 100 | nA | $V_{IO}$ = ± 1.00kVDC(1) |
| $C_{IO}$ | Capacitance Input-to-Output | | | 5.0 | | | 5.0 | | | 5.0 | pF | $V_{IO}$ = 0V, f = 1.00MHz(1) |
| $t_r$ | Output Rise Time | | | 10.0 | | | 10.0 | | | 10.0 | µs | $V_{CC}$ = 10.0V, $I_F$ = 10.0mA,(5) $R_L$ = 100Ω |
| $t_f$ | Output Fall Time | | | 10.0 | | | 10.0 | | | 10.0 | µs | |



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

**100% Processing**

| Screen | Mil-STD-750 Method | Conditions | 3N243TX 3N244TX 3N245TX |
|---|---|---|---|
| Pre-Cap Visual | | Optek's pre-cap visual | 100% |
| High Temperature Storage | 1032 | $T_A = 150^oC$, t = 24hrs. | 100% |
| Temperature Cycle | 1051 | Condition C, 20 cycles, 15 min. each extreme | 100% |
| Constant Acceleration | 2006 | 20K G, $Y_1$ only | 100% |
| High Temperature Reverse Bias | 1039 | Condition A, $T_A = 125^oC$, $V_{CE} = 24Vdc$, $I_F = 0$, t = 96hrs. min | 100% |
| Power Burn-In | 1039 | Condition B, $P_{DT} = 175\text{-}200mW$, $T_A = 25^oC$, $I_F = 40mA$, t = 160hrs. min | 100% |
| Hermetic Seal | 1071 | Fine: Condition H, $5 \times 10^{-8}$atm cc/sec Gross: Condition C | 100% |

**Group B Inspection** (performed on each inspection lot)

| Examination or Test | MIL-STD-750 | | LTPD |
|---|---|---|---|
| | Method | Conditions | |
| **Subgroup 1** | | | 15 |
| Solderability | 2026 | | |
| Resistance to Solvents | 1022 | | |
| **Subgroup 2** | | | 10 |
| Thermal Shock (temperature cycling) | 1051 | Condition C, 15 min at extremes, 20 cycles | |
| Hermetic Seal<br>Fine Leak<br>Gross Leak | 1071 | <br>Condition H, max leak rate = $5 \times 10^{-8}$atm cc/sec<br>Condition C | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 3** | | | 5 |
| Steady-State Operation Life | 1027 | $P_{DT} = 175\text{-}200mW$, $I_F = 20mA$, $T_A = 25^oC$ | |
| End Points | | Group A, Subgroup 2 | |
| Bond Strength | 2037 | All internal wires of each device shall be pulled separately. | 20 (c=0) |
| **Subgroup 4** | | | |
| Decap Internal Visual Inspection | 2075 | Visual criteria in accordance with qualified design. | 1 device |
| **Subgroup 6** | | | 7 |
| High Temperature Life (non-operating) | 1032 | t = 340hrs., $T_A = 150^oC$ | |

# Types 3N243TX, 3N244TX, 3N245TX

**Group C Inspection** (performed every six months while in production)

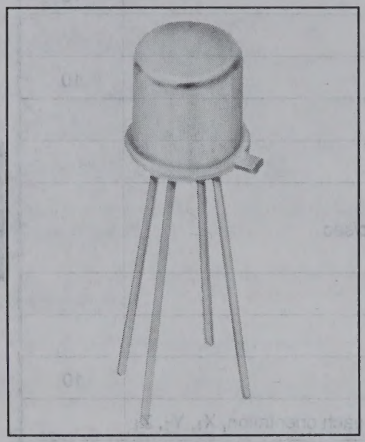
| Examination or Test | MIL-STD-750 | | LTPD |
|---|---|---|---|
| | Method | Conditions | |
| **Subgroup 1** | | | 15 |
| Physical Dimensions | 2066 | | |
| **Subgroup 2** | | | 10 |
| Thermal Shock (glass strain) | 1056 | Condition A | |
| Terminal Strength | 2036 | Condition E | |
| Hermetic Seal<br>Fine Leak<br>Gross Leak | 1071 | <br>Condition H, max leak rate = $5 \times 10^{-8}$atm cc/sec<br>Condition C | |
| Moisture Resistance | 1021 | Omit initial conditioning | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 3** | | | 10 |
| Shock | 2016 | Non-operating 1.5K G's, 0.5ms, 5 blows in each orientation, $X_1$, $Y_1$, $Z_1$ | |
| Vibration, Variable Frequency | 2056 | | |
| Consistant Acceleration | 2006 | 1 min in each orientation, $X_1$, $Y_1$, & $Z_1$ at 20K G's min | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 4** | | | 15 |
| Salt Atmosphere (corrosion) | 1041 | | |
| **Subgroup 5** | | | 15 |
| Not Applicable | | | |
| **Subgroup 6** | | | 10 |
| Steady-State Operational Life | 1026 | $P_{DT}$ = 175-200mW, $I_F$ = 20mA, $T_A$ = 25°C, t = 1000hrs. | |
| End Points | | Group A, Subgroup 2 | |

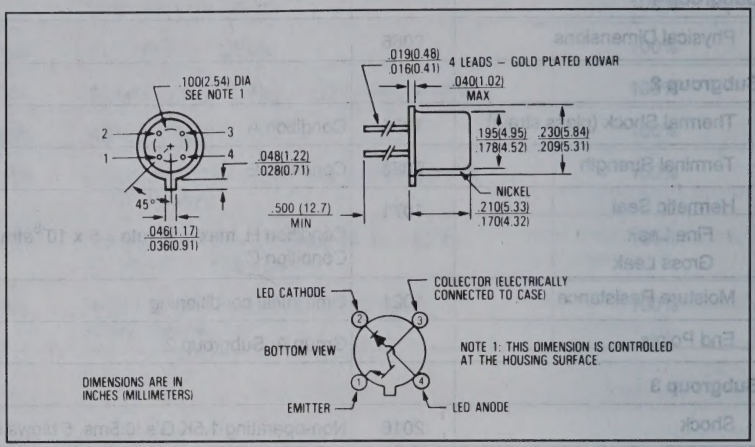


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Optically Coupled Isolators
## Types 3N261, 3N262, 3N263






### Features

- TO-72 hermetically sealed package
- 1 kVDC electrical isolation
- High current transfer ratio at low diode current drive
- TX-TXV process available (see Hi-Rel section)

### Description

The 3N261, 3N262, and 3N263 are JEDEC registered optically coupled isolators each consisting of an infrared emitting diode and an NPN silicon phototransistor mounted in a hermetically sealed TO-72 package.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ± 1.00kVDC(1) |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |
| **Input Diode** | |
| Forward DC Current | 40mA |
| Reverse Voltage | 2.0V |
| Power Dissipation | 60mW(3) |
| **Output Phototransistor** | |
| Continuous Collector Current | 30mA |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 200mW(4) |

**Notes:**
(1) Measured with input leads shorted together and output leads shorted together.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.6mW/°C above 25°C.
(4) Derate linearly 2.0mW/°C above 25°C.
(5) The input waveform is supplied by a generator with the following characteristics: $Z_{OUT}$ = 50Ω, tr ≤ 15ns, duty cycle ≅ 1%.

# Types 3N261, 3N262, 3N263

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

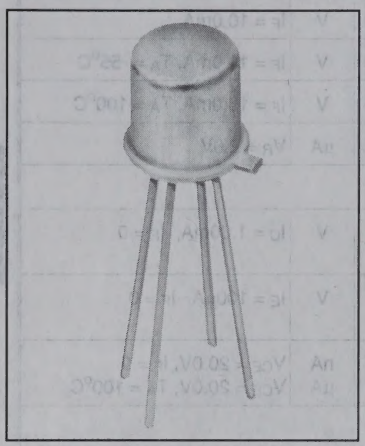
| Symbol | Parameter | 3N261 | | | 3N262 | | | 3N263 | | | Unit | Test Conditions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | | |
| **Input Diode** | | | | | | | | | | | | |
| $V_F$ | Forward Voltage | 0.80 | | 1.50 | 0.80 | | 1.50 | 0.80 | | 1.50 | V | $I_F = 10.0mA$ |
| | | 1.00 | | 1.70 | 1.00 | | 1.70 | 1.00 | | 1.70 | V | $I_F = 10.0mA$, $T_A = -55^oC$ |
| | | 0.70 | | 1.30 | 0.70 | | 1.30 | 0.70 | | 1.30 | V | $I_F = 10.0mA$, $T_A = 100^oC$ |
| $I_R$ | Reverse Current | | | 100 | | | 100 | | | 100 | µA | $V_R = 2.0V$ |
| **Output Phototransistor** | | | | | | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 40 | | | 40 | | | 40 | | | V | $I_C = 1.00mA$, $I_F = 0$ |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 7.0 | | | 7.0 | | | 7.0 | | | V | $I_E = 100µA$, $I_F = 0$ |
| $I_{CEO}$ | Collector Dark Current | | | 100 | | | 100 | | | 100 | nA | $V_{CE} = 20.0V$, $I_F = 0$ |
| | | | | 100 | | | 100 | | | 100 | µA | $V_{CE} = 20.0V$, $T_A = 100^oC$ |
| **Coupled** | | | | | | | | | | | | |
| $I_{C(on)}$ | On-State Collector Current | 0.50 | | | 1.00 | | 5.00 | 2.00 | | 10.00 | mA | $I_F = 1.0mA$, $V_{CE} = 5.0V$ |
| | | 0.70 | | | 1.40 | | | 2.80 | | | mA | $I_F = 2.0mA$, $V_{CE} = 5.0V$, $T_A = -55^oC$ |
| | | 0.50 | | | 1.00 | | | 2.00 | | | mA | $I_F = 2.0mA$, $V_{CE} = 5.0V$, $T_A = 100^oC$ |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 0.30 | | | | | | | V | $I_F = 2.0mA$, $I_C = 0.5mA$ |
| | | | | | | | 0.30 | | | | V | $I_F = 2.0mA$, $I_C = 1.0mA$ |
| | | | | | | | | | | 0.30 | V | $I_F = 2.0mA$, $I_C = 2.0mA$ |
| $I_{IO}$ | Leakage Input-to-Output | | | 100 | | | 100 | | | 100 | nA | $V_{IO} = \pm 1.00kVDC$[1] |
| $C_{IO}$ | Capacitance Input-to-Output | | | 5.0 | | | 5.0 | | | 5.0 | pF | $V_{IO} = 0V$, $f = 1.00MHz$[1] |
| $t_r$ | Output Rise Time | | | 20.0 | | | 20.0 | | | 25.0 | µs | $V_{CC} = 10.0V$, $I_F = 5.0mA$,[5] $R_L = 100\Omega$ |
| $t_f$ | Output Fall Time | | | 20.0 | | | 20.0 | | | 25.0 | µs | |

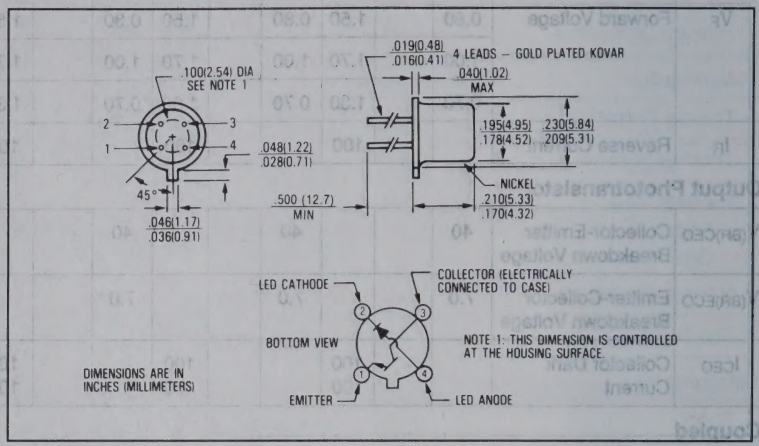


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# High Reliability Optically Coupled Isolators
## Types 3N261TX, 3N262TX, 3N263TX






### Features

- Processed to Optek's military screening program patterned after MIL-S-19500
- TO-72 hermetically sealed package
- 1 kVDC electrical isolation
- High current transfer ratio at low diode current drive

### Description

Each device in the series is a high reliability optically coupled isolator consisting of an infrared emitting diode and an NPN silicon phototransistor mounted in a hermetically sealed TO-72 package.

This series is identical to the JEDEC registered optically coupled isolators with additional high-reliability processing. This processing is patterned after MIL-S-19500 as shown in the accompanying table.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ±1.00kVDC(1) |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |
| **Input Diode** | |
| Forward DC Current | 40mA |
| Reverse Voltage | 2.0V |
| Power Dissipation | 60mW(3) |
| **Output Phototransistor** | |
| Continuous Collector Current | 30mA |
| Collector-Emitter Voltage | 30V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 200mW(4) |

**Notes:**
(1) Measured with input leads shorted together and output leads shorted together.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.60mW/°C above 25°C.
(4) Derate linearly 2.0mW/°C above 25°C.
(5) The input waveform is supplied by a generator with the following characteristics: $Z_{OUT}$ = 50Ω, tr ≤ 15ns, duty cycle ≅ 1%, pulse width ≅ 100µs.

# Types 3N261TX, 3N262TX, 3N263TX

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | 3N261TX | | | 3N262TX | | | 3N263TX | | | Unit | Test Conditions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | | |
| **Input Diode** | | | | | | | | | | | | |
| $V_F$ | Forward Voltage | 0.80 | | 1.50 | 0.80 | | 1.50 | 0.80 | | 1.50 | V | $I_F$ = 10.0mA |
| | | 1.00 | | 1.70 | 1.00 | | 1.70 | 1.00 | | 1.70 | V | $I_F$ = 10.0mA, $T_A$ = -55°C |
| | | 0.70 | | 1.30 | 0.70 | | 1.30 | 0.70 | | 1.30 | V | $I_F$ = 10.0mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | | 100 | | | 100 | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 40 | | | 40 | | | 40 | | | V | $I_C$ = 1.00mA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 7.0 | | | 7.0 | | | 7.0 | | | V | $I_E$ = 100µA |
| $I_{CEO}$ | Collector Dark Current | | | 100<br>100 | | | 100<br>100 | | | 100<br>100 | nA<br>µA | $V_{CE}$ = 10.0V<br>$V_{CE}$ = 10.0V, $T_A$ = 100°C |
| **Coupled** | | | | | | | | | | | | |
| $I_{C(on)}$ | On-State Collector Current | 0.50 | | | 1.00 | | 5.0 | 2.00 | | 10.0 | mA | $I_F$ = 1.0mA, $V_{CE}$ = 5.0V |
| | | 0.70 | | | 1.40 | | | 2.80 | | | mA | $I_F$ = 2.0mA, $V_{CE}$ = 5.0V, $T_A$ = -55°C |
| | | 0.50 | | | 1.00 | | | 2.00 | | | mA | $I_F$ = 2.0mA, $V_{CE}$ = 5.0V, $T_A$ = 100°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 0.30 | | | | | | | V | $I_F$ = 2.0mA, $I_C$ = 0.50mA |
| | | | | | | | 0.30 | | | | V | $I_F$ = 2.0mA, $I_C$ = 1.0mA |
| | | | | | | | | | | 0.30 | V | $I_F$ = 2.0mA, $I_C$ = 2.0mA |
| $I_{IO}$ | Leakage Input-to-Output | | | 10 | | | 10 | | | 10 | nA | $V_{IO}$ = ± 1.00kVDC(1) |
| $C_{IO}$ | Capacitance Input-to-Output | | | 5.0 | | | 5.0 | | | 5.0 | pF | $V_{IO}$ = 0V, f = 1.00MHz(1) |
| $t_r$ | Output Rise Time | | | 20.0 | | | 20.0 | | | 25.0 | µs | $V_{CC}$ = 10.0V, $I_F$ = 5.0mA,(5) $R_L$ = 100Ω |
| $t_f$ | Output Fall Time | | | 20.0 | | | 20.0 | | | 25.0 | µs | |

HI REL OPTO COMPONENTS

**100% Processing**

| Screen | Mil-STD-750 Method | Conditions | 3N261TX 3N262TX 3N263TX |
|---|---|---|---|
| Pre-Cap Visual | | Optek's pre-cap visual(6) | 100% |
| High Temperature Storage | 1032 | $T_A$ = 150°C, t = 24hrs. | 100% |
| Temperature Cycle | 1051 | Condition C, 20 cycles, 15 min each extreme | 100% |
| Constant Acceleration | 2006 | 20K G's, $Y_1$ only | 100% |
| High Temperature Reverse Bias | 1039 | Condition A, $T_A$ = 125°C, $V_{CE}$ = 24Vdc, $I_F$ = 0, t = 96hrs. min | 100% |
| Power Burn-In | 1039 | Condition B, $P_{DT}$ = 175-200mW, $T_A$ = 25°C, $I_F$ = 40mA, t = 160hrs. min | 100% |
| Hermetic Seal | 1071 | Fine: Condition H, 5 X $10^{-8}$atm cc/sec<br>Gross: Condition C | 100% |

(6) Visual inspection based upon Optek's interpretation of the requirements of a JANTX device per MIL-S-19500/548 specification.

**Group B Inspection** (performed on each inspection lot)

| Examination or Test | MIL-STD-750 | | LTPD |
|---|---|---|---|
| | Method | Conditions | |
| **Subgroup 1** | | | 15 |
| Solderability | 2026 | | |
| Resistance to Solvents | 1022 | | |
| **Subgroup 2** | | | 10 |
| Thermal Shock (temperature cycling) | 1051 | Condition C, 15 min at extremes, 20 cycles | |
| Hermetic Seal<br>Fine Leak<br>Gross Leak | 1071 | <br>Condition H, max leak rate = 5 x $10^{-8}$atm cc/sec<br>Condition C | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 3** | | | 5 |
| Steady-State Operation Life | 1027 | $P_{DT}$ = 175-200mW, $I_F$ = 20mA, $T_A$ = 25°C | |
| End Points | | Group A, Subgroup 2 | |
| Bond Strength | 2037 | All internal wires of each device shall be pulled separately. | 20 (c=0) |
| **Subgroup 4** | | | |
| Decap Internal Visual Inspection | 2075 | Visual criteria in accordance with qualified design. | 1 device |
| **Subgroup 6** | | | 7 |
| High Temperature Life (non-operating) | 1032 | t = 340hrs., $T_A$ = 150°C | |

# Types 3N261TX, 3N262TX, 3N263TX

**Group C Inspection** (performed every six months while in production)

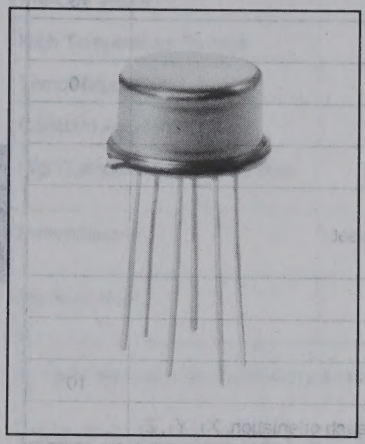
| Examination or Test | MIL-STD-750 | | LTPD |
|---|---|---|---|
| | Method | Conditions | |
| **Subgroup 1** | | | 15 |
| Physical Dimensions | 2066 | | |
| **Subgroup 2** | | | 10 |
| Thermal Shock (glass strain) | 1056 | Condition A | |
| Terminal Strength | 2036 | Condition E | |
| Hermetic Seal<br>Fine Leak<br>Gross Leak | 1071 | <br>Condition H, max leak rate = $5 \times 10^{-8}$atm cc/sec<br>Condition C | |
| Moisture Resistance | 1021 | Omit initial conditioning | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 3** | | | 10 |
| Shock | 2016 | Non-operating 1.5K G's, 0.5ms, 5 blows in each orientation, $X_1$, $Y_1$, $Z_1$ | |
| Vibration, Variable Frequency | 2056 | | |
| Constant Acceleration | 2006 | 1 min in each orientation, $X_1$, $Y_1$, & $Z_1$ at 20K G's min | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 4** | | | 15 |
| Salt Atmosphere (corrosion) | 1041 | | |
| **Subgroup 5** | | | 15 |
| Barometric Pressure | 1001 | Not Applicable | |
| **Subgroup 6** | | | 10 |
| Steady-State Operational Life | 1026 | $P_{DT}$ = 175-200mW, $I_F$ = 20mA, $T_A = 25^{\circ}C$, t = 1000hrs. | |
| End Points | | Group A, Subgroup 2 | |

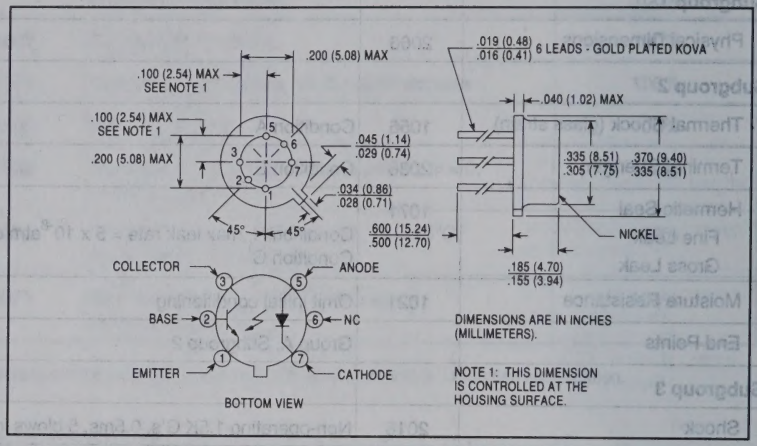


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Optically Coupled Isolators
## Types 4N22A, 4N23A, 4N24A






### Features

- High current transfer ratio
- TO-78 hermetic package
- 1.0 kV electrical isolation
- Base lead provided for conventional transistor biasing
- JANTX version available per MIL-S-19500/486
- Higher breakdown voltage devices available as the "HV" series
- Patent number 4124860

### Description

The 4N22A, 4N23A, and 4N24A are optically coupled isolators each consisting of a gallium arsenide LED and a silicon phototransistor mounted side by side and coupled on a ceramic substrate in a hermetic TO-78 package. All electrical characteristics for the 4N22A, 4N23A, and 4N24A are per the JEDEC registered test conditions. The 4N22AHV, 4N23AHV, and 4N24AHV series of optoisolators are available when higher breakdown voltages are required.

The TO-78 package offers high power dissipation, ease of heat sinking and superior operation in hostile environments.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ± 1.00 kVDC(1) |
| Storage and Operating Temperature Range | -65°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |
| **Input Diode** | |
| Forward DC Current (65°C or below) | 40mA |
| Reverse Voltage | 2.0V |
| Peak Forward Current (1 µs pulse width, 300 pps) | 1.00A |
| Power Dissipation | 60mW(3) |
| **Output Sensor** | |
| Continuous Collector Current | 50mA |
| Collector-Emitter Voltage | 35V |
| Collector-Base Voltage | 35V |
| Emitter-Base Voltage | 4.0V |
| Power Dissipation | 300mW(4) |

**Notes:**
(1) Measured with input diode leads shorted together and output leads shorted together.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 1.0mW/°C above 65°C.
(4) Derate linearly 3.0mW/°C above 25°C.
(5) Not 100% tested.

# Types 4N22A, 4N23A, 4N24A

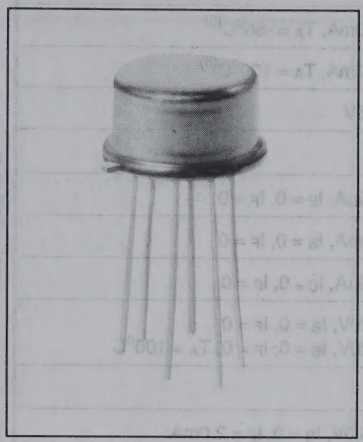
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

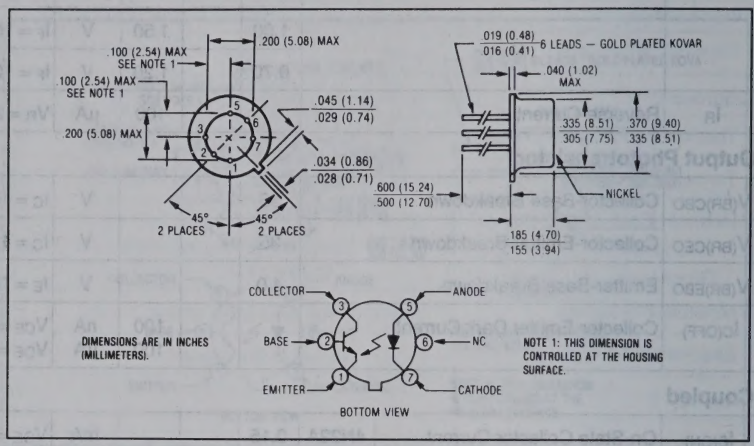
| Symbol | Parameter | Type | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | 0.80 | | 1.30 | V | $I_F$ = 10.0mA |
| | | | 1.00 | | 1.50 | V | $I_F$ = 10.0mA, $T_A$ = -55°C(5) |
| | | | 0.70 | | 1.20 | V | $I_F$ = 10.0mA, $T_A$ = 100°C(5) |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown | | 35 | | | V | $I_C$ = 100µA, $I_E$ = 0, $I_F$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown | | 35 | | | V | $I_C$ = 1.0mA, $I_B$ = 0, $I_F$ = 0 |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown | | 4.0 | | | V | $I_E$ = 100µA, $I_C$ = 0, $I_F$ = 0 |
| $I_{C(OFF)}$ | Collector-Emitter Dark Current | | | | 100 | nA | $V_{CE}$ = 20V, $I_B$ = 0, $I_F$ = 0 |
| | | | | | 100 | µA | $V_{CE}$ = 20V, $I_B$ = 0, $I_F$ = 0, $T_A$ = 100°C |
| **Coupled** | | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 4N22A | 0.15 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA |
| | | | 2.50 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA |
| | | | 1.00 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA, $T_A$ = -55°C |
| | | | 1.00 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA, $T_A$ = 100°C |
| | | 4N23A | 0.20 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA |
| | | | 6.00 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA |
| | | | 2.50 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA, $T_A$ = -55°C |
| | | | 2.50 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA, $T_A$ = 100°C |
| | | 4N24A | 0.40 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA |
| | | | 10.0 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA |
| | | | 4.00 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA, $T_A$ = -55°C |
| | | | 4.00 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA, $T_A$ = 100°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation | 4N22A | | | 0.30 | V | $I_C$ = 2.5mA, $I_B$ = 0, $I_F$ = 20.0mA |
| | | 4N23A | | | 0.30 | | $I_C$ = 5.0mA, $I_B$ = 0, $I_F$ = 20.0mA |
| | | 4N24A | | | 0.30 | | $I_C$ = 10.0mA, $I_B$ = 0, $I_F$ = 20.0mA |
| $h_{FE}$ | DC Current Gain | 4N22A | 200 | | | | $V_{CE}$ = 5.0V, $I_C$ = 10.0mA, $I_F$ = 0mA |
| | | 4N23A | 300 | | | | |
| | | 4N24A | 400 | | | | |
| $R_{IO}$ | Resistance (Input to Output) | | $10^{11}$ | | | Ω | $V_{IO}$ = ± 1000Vdc(1) |
| $C_{IO}$ | Capacitance (Input to Output) | | | | 5.0 | pF | $V_{IO}$ = 0.0V, f = 1.0MHz(1) |
| $t_r$ | Output Rise Time | 4N22A | | | 15.0 | µs | $V_{CC}$ = 10.0V, $I_F$ = 10.0mA, $R_L$ = 100Ω |
| | | 4N23A | | | 15.0 | µs | |
| | | 4N24A | | | 20.0 | µs | |
| $t_f$ | Output Fall Time | 4N22A | | | 15.0 | µs | |
| | | 4N23A | | | 15.0 | µs | |
| | | 4N24A | | | 20.0 | µs | |

HI REL OPTO COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Optically Coupled Isolators
## Types JANTX, JANTXV-4N22A, 4N23A, 4N24A






### Features

- High-Reliability processed to MIL-S-19500/486
- 1 kV electrical isolation
- Base contact is provided for conventional transistor biasing
- JANTX, JANTXV qualified
- Patent number 4124860

### Description

The JANTX and JANTXV series of the 4N22A, 4N23A and 4N24A are JEDEC registered, DESC qualified, optically coupled isolators. High reliability processing on the devices is performed in accordance with MIL-S-19500/486.

Each device in the series consists of an infrared emitting diode and a NPN silicon phototransistor mounted in a hermetically sealed TO-78 package. The suffix letter "A" denotes the collector is electrically isolated from the case.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ± 1.00 kVDC(1) |
| Storage and Operating Temperature Range | -65°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |
| **Input Diode** | |
| Forward DC Current (65°C or below) | 40mA |
| Reverse Voltage | 2.0V |
| Peak Forward Current (1 µs pulse width, 300 pps) | 1.00A |
| Power Dissipation | 60mW(3) |
| **Output Sensor** | |
| Continuous Collector Current | 50mA |
| Collector-Emitter Voltage | 35V |
| Collector-Base Voltage | 35V |
| Emitter-Base Voltage | 4.0V |
| Power Dissipation | 300mW(4) |

**Notes:**
(1) Measured with input diode leads shorted together and output leads shorted together.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 1.0mW/°C above 65°C.
(4) Derate linearly 3.0mW/°C above 25°C.
(5) Not 100% tested.

# Types JANTX, JANTXV - 4N22A, 4N23A, 4N24A

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | JANTX, JANTXV | | | | | | Units | Test Conditions |
|---|---|---|---|---|---|---|---|---|---|
| | | 4N22A | | 4N23A | | 4N24A | | | |
| | | Min | Max | Min | Max | Min | Max | | |
| **Input Diode** | | | | | | | | | |
| $V_F$ | Forward Voltage | 0.80<br>1.00<br>0.70 | 1.30<br>1.50<br>1.20 | 0.80<br>1.00<br>0.70 | 1.30<br>1.50<br>1.20 | 0.80<br>1.00<br>0.70 | 1.30<br>1.50<br>1.20 | V<br>V<br>V | $I_F$ = 10.0mA<br>$I_F$ = 10.0mA, $T_A$ = -55°C(5)<br>$I_F$ = 10.0mA, $T_A$ = 100°C(5) |
| $I_R$ | Reverse Current | | 100 | | 100 | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 35 | | 35 | | 35 | | V | $I_C$ = 1.0mA, $I_B$ = 0, $I_F$ = 0 |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 35 | | 35 | | 35 | | V | $I_C$ = 100µA, $I_B$ = 0, $I_F$ = 0 |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | 4.0 | | 4.0 | | 4.0 | | V | $I_E$ = 100µA, $I_C$ = 0, $I_F$ = 0 |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 100<br>100 | | 100<br>100 | | 100<br>100 | nA<br>µA | $V_{CE}$ = 20V, $I_B$ = 0, $I_F$ = 0<br>$V_{CE}$ = 20V, $I_B$ = 0, $I_F$ = 0, $T_A$ = 100°C |
| **Coupled** | | | | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 0.15<br>2.50<br>1.00<br><br>1.00 | | 0.20<br>6.00<br>2.50<br><br>2.50 | | 0.40<br>10.0<br>4.00<br><br>4.00 | | mA<br>mA<br>mA<br><br>mA | $I_F$ = 2.0mA, $V_{CE}$ = 5V, $I_B$ = 0<br>$I_F$ = 10.0mA, $V_{CE}$ = 5V, $I_B$ = 0<br>$I_F$ = 10.0mA, $V_{CE}$ = 5V, $I_B$ = 0, $T_A$ = -55°C<br>$I_F$ = 10.0mA, $V_{CE}$ = 5V, $I_B$ = 0, $T_A$ = 100°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.30 | | 0.30 | | 0.30 | V | $I_F$ = 20mA, $I_C$ = 2.5mA, $I_B$ = 0<br>$I_F$ = 20mA, $I_C$ = 5.0mA, $I_B$ = 0<br>$I_F$ = 20mA, $I_C$ = 10.0mA, $I_B$ = 0 |
| $h_{FE}$ | DC Current Gain | 200 | | 300 | | 400 | | | $V_{CE}$ = 5.0V, $I_C$ = 10.0mA, $I_F$ = 0mA |
| $R_{IO}$ | Resistance (Input-to-Output) | $10^{11}$ | | $10^{11}$ | | $10^{11}$ | | Ω | $V_{IO}$ = ± 1.0VDC(1) |
| $C_{IO}$ | Capacitance (Input to Output) | | 5.0 | | 5.0 | | 5.0 | pF | $V_{IO}$ = 0V, f = 1.0MHz(1) |
| $t_r$<br>$t_f$ | Output Rise Time<br>Output Fall Time | | 15.0<br>15.0 | | 15.0<br>15.0 | | 20.0<br>20.0 | µs<br>µs | $V_{CC}$ = 10.0V, $I_F$ = 10.0mA, $R_L$ = 100Ω |



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road, Carrollton, Texas 75006 (214)323-2200 TLX 215849 Fax (214)323-2396

# Types JANTX, JANTXV - 4N22A, 4N23A, 4N24A

OPTEK

**Simplified JANTX Product Flow**

| JANTX | JANTXV |
|---|---|
| 100% Processing Pluse Sample Environmental and Life Testing | Same as JANTX Plus 100% Internal Visual Inspection |
| Commercial Product<br>↓<br>100% Processing<br>↓<br>Group A, B, C Sample Test<br>↓<br>Ship | 100% Pre-Cap Visual<br>↓<br>100% Processing<br>↓<br>Group A, B, C Sample Test<br>↓<br>Ship |

**100% Processing**

| Screen | MIL-STD-750 Method | Conditions | JANTX4N22A JANTX4N23A JANTX4N24A | JANTXV4N22A JANTXV4N23A JANTXV4N24A |
|---|---|---|---|---|
| Pre-Cap Visual | | Per Mil-S-19500/486 | — | 100% |
| High Temperature Storage | | $T_A = 125^oC$, t = 72hrs. | 100% | 100% |
| Temperature Cycle | 1051 | Condition B, 10 Cycles, 15 min @ extreme | 100% | 100% |
| Constant Acceleration | 2006 | 20K G's, $Y_1$ only | 100% | 100% |
| High Temperature Reverse Bias | 1039 | Condition A, $T_A = 125^oC$, $V_{CB} = 20V$, $I_F = 0$, t = 96hrs. min | 100% | 100% |
| Power Burn-In | 1039 | Condition B, $V_{CC} = 20V$, $V_{CE} = 10 \pm 5V$, $Pt = 275 \pm 25mW$, $T_A = 25^oC$, $I_F = 40mA$, t = 168hrs. min | 100% | 100% |
| Monitored Temperature Cycle | 1051 | Condition B, Monitored, 1 Cycle, 15 min @ extreme | 100% | 100% |
| Hermetic Seal | 1071 | Fine: Condition G or H, $1 \times 10^{-7}$ atm cc/sec<br>Gross: Condition C | 100% | 100% |
| External Visual Examination | 2071 | | 100% | 100% |

# Types JANTX, JANTXV - 4N22A, 4N23A, 4N24A

**Quality and Reliability Lot Acceptance Testing**

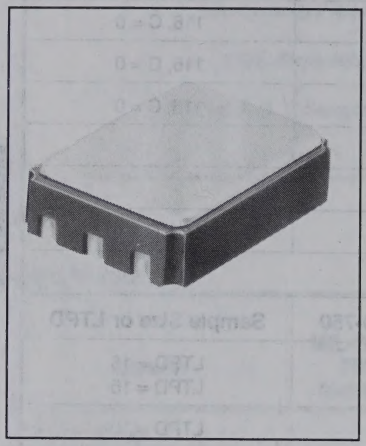
| Subgroup | Examination or Test | Method MIL-STD-750 | Sample size or LTPD |
|---|---|---|---|
| **Group A MIL-S-19500/486** | | | |
| 1 | Visual & Mechanical | 2071 | LTPD = 5 |
| 2 | DC Electrical | Table 1 (/486) | 116, C = 0 |
| 3 | Temperature Tests | Table 1 (/486) | 116, C = 0 |
| 4 | Dynamic Tests | Table 1 (/486) | 116, C = 0 |
| 5 | Not Applicable | | |
| 6 | Not Applicable | | |
| 7 | Monitored Temp Cycle (1 Cycle) | 1051 | 116, C = 0 |
| **Group B MIL-S-19500/486** | | | |
| **Subgroup** | **Examination or Test** | **Method MIL-STD-750** | **Sample Size or LTPD** |
| 1 | Solderability<br>Resistance to Solvents | 2026<br>1022 | LTPD = 15<br>LTPD = 15 |
| 2 | Thermal Shock<br>Hermetic Seal (Condition H and C)<br>End Points | 1051<br>1071<br>Table IV (/486) | LTPD = 10 |
| 3 | Steady State Life<br>End Points | 1027<br>Table IV (/486) | LTPD = 5 |
| 4 | Decap Internal Visual<br>Bond Strength | 2075<br>2037 | 1, C = 0<br>20 Wires |
| 5 | Not Applicable | | |
| 6 | High Temp Life (Non-Operating)<br>End Points | 1032<br>Table IV (/486) | LTPD = 7 |
| **Group C Mil-S-19500/486 (Performed Every 6 Months)** | | | |
| **Subgroup** | **Examination or Test** | **Method MIL-STD-750** | **Sample Size or LTPD** |
| 1 | Physical Dimensions | 2066 | LTPD = 15 |
| 2 | Thermal Shock (Glass Strain)<br>Terminal Strength (Not Applicable)<br>Hermetic Seal (Condition H and C)<br>Moisture Resistance<br>External Visual<br>End Points | 1056<br>—<br>1071<br>1021<br>2071<br>Table IV (/486) | LTPD = 10 |
| 3 | Shock<br>Vibration, Variable Frequency<br>Constant Acceleration<br>End Points | 2016<br>2056<br>2006<br>Table IV (/486) | LTPD = 10 |
| 4 | Salt Atmosphere | 1041 | LTPD = 15 |
| 5 | Not Applicable | | |
| 6 | Steady State Operation Life (1000 hrs.)<br>End Points | 1026<br>Table IV (/486) | LTPD = 10 |

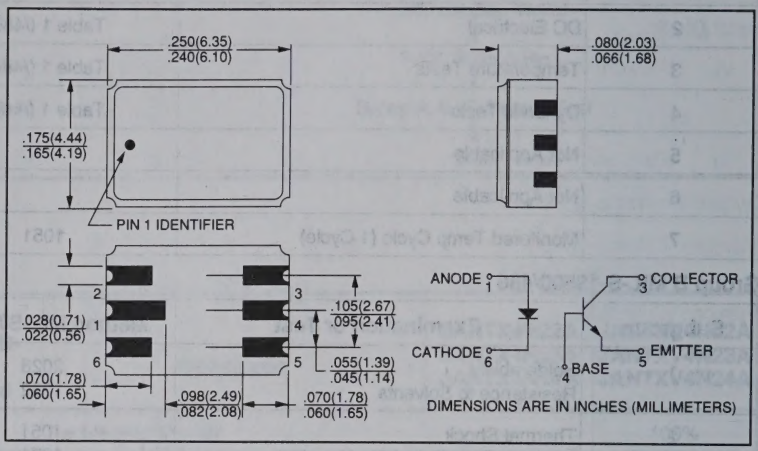


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Surface Mount Optically Coupled Isolators
## Types JANTX, JANTXV - 4N22AU, 4N23AU, 4N24AU






### Features

- JANTX, JANTXV qualified per MIL-S-19500/486
- Surface Mountable
- 1 kV Electrical Isolation
- Base contact provided for conventional transistor biasing

### Description

The JANTX and JANTXV series 4N22AU, 4N23AU, and 4N24AU are DESC qualified, surface mount optically coupled isolators. High reliability processing on the devices is performed in accordance with MIL-S-19500/486.

Each device in the series consists of an infrared emitting diode and an NPN silicon phototransistor mounted in a hermetically sealed ceramic surface mount package. The suffix letter "A" denotes the collector is electrically isolated from the case and "U" denotes surface mount package.

This data sheet is provided as a summary reference. Refer to MIL-S-19500/486 for complete requirements.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ± 1.0 kVDC(1) |
| Storage and Operating Temperature Range | -65°C to +125°C |
| Soldering Temperature (vapor phase reflow) | 215°C |
| Soldering Temperature (heated collet for 5 sec) | 260°C |
| **Input Diode** | |
| Forward DC Current (65°C or below) | 40mA(2) |
| Reverse Voltage | 2.0V |
| Peak Forward Current (1 µs pulse width, 300 pps) | 1.00A |
| **Output Sensor** | |
| Continuous Collector Current | 50mA |
| Collector-Emitter Voltage | 35V |
| Collector-Base Voltage | 35V |
| Emitter-Base Voltage | 4.0V |
| Power Dissipation | 300mW(3) |

**Notes:**
(1) Measured with input diode leads shorted together and output leads shorted together.
(2) Derate linearly 0.67mA/°C above 65°C.
(3) Derate linearly 3.0mW/°C above 25°C.

# Types JANTX, JANTXV - 4N22AU, 4N23AU, 4N24AU

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Type | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | 0.80 | | 1.30 | V | $I_F$ = 10.0mA |
| | | | 1.00 | | 1.50 | V | $I_F$ = 10.0mA, $T_A$ = -55°C |
| | | | 0.70 | | 1.20 | V | $I_F$ = 10.0mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | | 35 | | | V | $I_C$ = 100µA, $I_E$ = 0, $I_F$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 35 | | | V | $I_C$ = 1.0mA, $I_B$ = 0, $I_F$ = 0 |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | | 4.0 | | | V | $I_E$ = 100µA, $I_C$ = 0, $I_F$ = 0 |
| $I_{C(OFF)}$ | Collector-Emitter Dark Current | | | | 100 | nA | $V_{CE}$ = 20V, $I_B$ = 0, $I_F$ = 0 |
| | | | | | 100 | µA | $V_{CE}$ = 20V, $I_B$ = 0, $I_F$ = 0, $T_A$ = 100°C |
| **Coupled** | | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 4N22AU | 0.15 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA |
| | | | 2.50 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA |
| | | | 1.00 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA, $T_A$ = -55°C |
| | | | 1.00 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA, $T_A$ = 100°C |
| | | 4N23AU | 0.20 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA |
| | | | 6.00 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA |
| | | | 2.50 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA, $T_A$ = -55°C |
| | | | 2.50 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA, $T_A$ = 100°C |
| | | 4N24AU | 0.40 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA |
| | | | 10.00 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA |
| | | | 4.00 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA, $T_A$ = -55°C |
| | | | 4.00 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 10.0mA, $T_A$ = 100°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | 4N22AU | | | 0.30 | V | $I_C$ = 2.5mA, $I_B$ = 0, $I_F$ = 20.0mA |
| | | 4N23AU | | | 0.30 | | $I_C$ = 5.0mA, $I_B$ = 0, $I_F$ = 20.0mA |
| | | 4N24AU | | | 0.30 | | $I_C$ = 10.0mA, $I_B$ = 0, $I_F$ = 20.0mA |
| $h_{FE}$ | DC Current Gain | 4N22AU | 200 | | | | $V_{CE}$ = 5.0V, $I_C$ = 10.0mA, $I_F$ = 0mA |
| | | 4N23AU | 300 | | | | |
| | | 4N24AU | 400 | | | | |
| $R_{IO}$ | Resistance (Input to Output) | | $10^{11}$ | | | Ω | $V_{IO}$ = ± 1000Vdc(1) |
| $C_{IO}$ | Capacitance (Input to Output) | | | | 5.0 | pF | $V_{IO}$ = 0.0V, f = 1.0MHz(1) |
| $t_r$ | Output Rise Time | 4N22AU | | | 15.0 | µs | $V_{CC}$ = 10.0V, $I_F$ = 10.0mA, $R_L$ = 100Ω |
| | | 4N23AU | | | 15.0 | µs | |
| | | 4N24AU | | | 20.0 | µs | |
| $t_f$ | Output Fall Time | 4N22AU | | | 15.0 | µs | |
| | | 4N23AU | | | 15.0 | µs | |
| | | 4N24AU | | | 20.0 | µs | |



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Types JANTX, JANTXV - 4N22AU, 4N23AU, 4N24AU

**Simplified JANTX Product Flow**

| JANTX | JANTXV |
|---|---|
| 100% Processing, Plus Sample Environmental and Life Testing | Same as JANTX Plus 100% Internal Visual Inspection |
| JAN Qualified Build<br>↓<br>100% Processing<br>↓<br>Group A, B, C Sample Test<br>↓<br>Ship | 100% Pre-Cap Visual<br>↓<br>100% Processing<br>↓<br>Group A, B, C Sample Test<br>↓<br>Ship |

**100% Processing**

| Screen | MIL-STD-750 Method | Conditions | JANTX4N22AU<br>JANTX4N23AU<br>JANTX4N24AU | JANTXV4N22AU<br>JANTXV4N23AU<br>JANTXV4N24AU |
|---|---|---|---|---|
| Pre-Cap Visual | 2072 | | — | 100% |
| High Temperature Storage | 1051 | $T_A = 125^oC$, t = 24hrs. | 100% | 100% |
| Temperature Cycle | 1051 | Condition B, 10 Cycles, 15 min @ -55°C to +125°C | 100% | 100% |
| Constant Acceleration | 2006 | 20K G's, $Y_1$ only | 100% | 100% |
| Hermetic Seal | 1071 | Fine: Condition H, 5 x $10^{-8}$atm cc/sec<br>Gross: Condition C | 100% | 100% |
| High Temperature Reverse Bias | 1039 | Condition A, $T_A = 125^oC$, $V_{CB} = 28V$, $I_F = 0$, t = 48hrs. min | 100% | 100% |
| Interim Electrical | — | | 100% | 100% |
| Power Burn-In | 1039 | Condition B, $V_{CC} = 20V$, $V_{CE} = 10 \pm 5V$, $Pt = 275 \pm 25mW$, $T_A = 25^oC$, $I_F = 40mA$, t = 168hrs. min | 100% | 100% |
| Final Electrical | — | | 100% | 100% |

# Types JANTX, JANTXV - 4N22AU, 4N23AU, 4N24AU

**Quality and Reliability Lot Acceptance Testing**

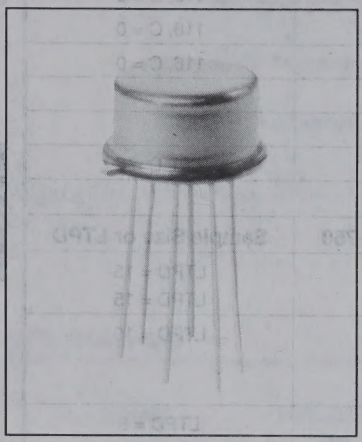
| Subgroup | Examination or Test | Method MIL-STD-750 | Sample size or LTPD |
|---|---|---|---|
| **Group A MIL-S-19500/486** | | | |
| 1 | Visual & Mechanical | 2071 | LTPD = 5 |
| 2 | DC Electrical | Table 1 (/486) | 116, C = 0 |
| 3 | Temperature Tests | Table 1 (/486) | 116, C = 0 |
| 4 | Dynamic Tests | Table 1 (/486) | 116, C = 0 |
| 5 | Not Applicable | | |
| 6 | Not Applicable | | |
| 7 | Monitored Temp Cycle (1 Cycle) | 1051 | 116, C = 0 |
| **Group B MIL-S-19500/486** | | | |
| **Subgroup** | **Examination or Test** | **Method MIL-STD-750** | **Sample Size or LTPD** |
| 1 | Solderability<br>Resistance to Solvents | 2026<br>1022 | LTPD = 15<br>LTPD = 15 |
| 2 | Thermal Shock<br>Hermetic Seal (Condition H and C)<br>End Points | 1051<br>1071<br>Table IV (/486) | LTPD = 10 |
| 3 | Steady State Life<br>End Points | 1027<br>Table IV (/486) | LTPD = 5 |
| 4 | Decap Internal Visual<br>Bond Strength | 2075<br>2037 | 1, C = 0<br>20 Wires |
| 5 | Not Applicable | | |
| 6 | High Temp Life (Non-Operating)<br>End Points | 1032<br>Table IV (/486) | LTPD = 7 |
| **Group C Mil-S-19500/486 (Performed Every 6 Months)** | | | |
| **Subgroup** | **Examination or Test** | **Method MIL-STD-750** | **Sample Size or LTPD** |
| 1 | Physical Dimensions | 2066 | LTPD = 15 |
| 2 | Thermal Shock (Glass Strain)<br>Terminal Strength (Not Applicable)<br>Hermetic Seal (Condition H and C)<br>Moisture Resistance<br>External Visual<br>End Points | 1056<br>—<br>1071<br>1021<br>2071<br>Table IV (/486) | LTPD = 10 |
| 3 | Shock<br>Vibration, Variable Frequency<br>Constant Acceleration<br>End Points | 2016<br>2056<br>2006<br>Table IV (/486) | LTPD = 10 |
| 4 | Salt Atmosphere | 1041 | LTPD = 15 |
| 5 | Not Applicable | | |
| 6 | Steady State Operation Life (1000 hrs.)<br>End Points | 1026<br>Table IV (/486) | LTPD = 10 |

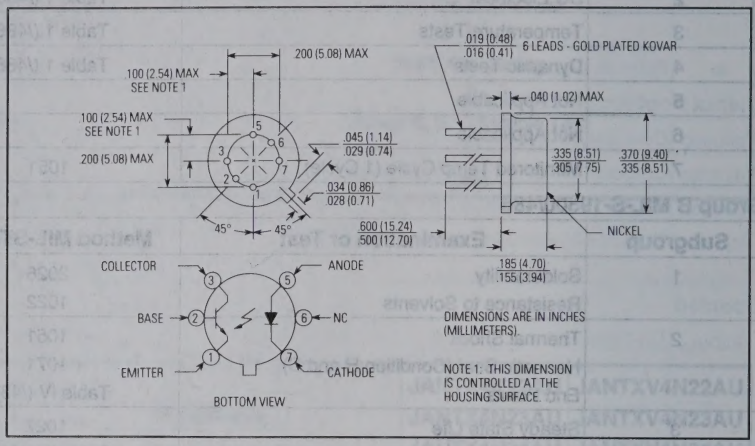


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Optically Coupled Isolators
## Types 4N47, 4N48, 4N49






### Features

- High current transfer ratio
- TO-78 hermetic package
- 1.0 kV electrical isolation
- Base lead provided for conventional transistor biasing
- JANTX version available per MIL-S-19500/548
- Higher breakdown voltage devices available as the "HV" series
- Patent number 4124860

### Description

The 4N47, 4N48, and 4N49 are optically coupled isolators each consisting of an infrared light emitting diode and a silicon phototransistor mounted side by side on a ceramic substrate and coupled in a hermetic TO-78 package. All electrical characteristics are according to the JEDEC registered 4N47, 4N48, and 4N49 test conditions. The 4N47HV, 4N48HV, and 4N49HV series of optoisolators are available when higher breakdown voltages are required.

The TO-78 package offers high power dissipation, ease of heat sinking and superior operation in hostile environments.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ± 1.00kVDC(1) |
| Storage Temperature Range | -55°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Soldering Temperature [1/16 in. (1.6mm)) from case for 5 sec. with soldering iron] | 240°C |
| **Input Diode** | |
| Forward DC Current (65°C or below) | 40mA |
| Reverse Voltage | 2.0V |
| Power Dissipation | 60mW(2) |
| **Output Phototransistor** | |
| Continuous Collector Current | 50mA |
| Collector-Base Voltage | 45V(3) |
| Collector-Emitter Voltage | 40V |
| Emitter-Base Voltage | 7.0V |
| Power Dissipation | 300mW(4) |

**Notes:**
(1) Measured with input leads shorted together and output leads shorted together.
(2) Derate linearly 1.00mW/°C above 65°C.
(3) 4N47HV, 4N48HV, and 4N49HV are available rated at 55V minimum.
(4) Derate linearly 3.0mW/°C above 25°C.

# Types 4N47, 4N48, 4N49

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Type | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | 0.80 | | 1.50 | V | $I_F$ = 10.0mA |
| | | | 1.00 | | 1.70 | V | $I_F$ = 10.0mA, $T_A$ = -55°C |
| | | | 0.70 | | 1.30 | V | $I_F$ = 10.0mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage(3) | | 45 | | | V | $I_C$ = 100µA, $I_E$ = 0, $I_F$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage(3) | | 40 | | | V | $I_C$ = 1.0mA, $I_B$ = 0, $I_F$ = 0 |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | | 7.0 | | | V | $I_E$ = 100µA, $I_C$ = 0, $I_F$ = 0 |
| $I_{C(OFF)}$ | Collector-Emitter Dark Current | | | | 100 | nA | $V_{CE}$ = 20V, $I_B$ = 0, $I_F$ = 0 |
| | | | | | 100 | µA | $V_{CE}$ = 20V, $I_B$ = 0, $I_F$ = 0, $T_A$ = 100°C |
| $I_{CB(OFF)}$ | Collector-Base Dark Current | | | | 100 | nA | $V_{CB}$ = 20V, $I_B$ = 0, $I_F$ = 0 |
| **Coupled** | | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 4N47 | 0.5 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 1.0mA |
| | | | 0.7 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA, $T_A$ = -55°C |
| | | | 0.5 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA, $T_A$ = 100°C |
| | | 4N48 | 1.0 | | 5.0 | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 1.0mA |
| | | | 1.4 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA, $T_A$ = -55°C |
| | | | 1.0 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA, $T_A$ = 100°C |
| | | 4N49 | 2.0 | | 10.0 | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 1.0mA |
| | | | 2.8 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA, $T_A$ = -55°C |
| | | | 2.0 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA, $T_A$ = 100°C |
| $I_{CB(ON)}$ | On-State Collector Base | | 30 | | | µA | $V_{CB}$ = 5.0V, $I_E$ = 0, $I_F$ = 10mA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | 4N47 | | | 0.30 | V | $I_C$ = 0.5mA, $I_B$ = 0, $I_F$ = 2.0mA |
| | | 4N48 | | | 0.30 | V | $I_C$ = 1.0mA, $I_B$ = 0, $I_F$ = 2.0mA |
| | | 4N49 | | | 0.30 | V | $I_C$ = 2.0mA, $I_B$ = 0, $I_F$ = 2.0mA |
| $h_{FE}$ | DC Current Gain | 4N47 | 100 | | | | $V_{CE}$ = 5.0V, $I_C$ = 10.0mA, $I_F$ = 0mA |
| | | 4N48 | 100 | | | | |
| | | 4N49 | 100 | | | | |
| $R_{IO}$ | Resistance (Input to Output) | | $10^{11}$ | | | Ω | $V_{IO}$ = ± 1000Vdc(1) |
| $C_{IO}$ | Capacitance (Input to Output) | | | | 5.0 | pF | $V_{IO}$ = 0.0V, f = 1.0MHz(1) |
| $t_r$ | Output Rise Time | 4N47 | | | 20.0 | µs | $V_{CC}$ = 10.0V, $I_F$ = 5.0mA, $R_L$ = 100Ω |
| | | 4N48 | | | 20.0 | µs | |
| | | 4N49 | | | 25.0 | µs | |
| $t_f$ | Output Fall Time | 4N47 | | | 20.0 | µs | |
| | | 4N48 | | | 20.0 | µs | |
| | | 4N49 | | | 25.0 | µs | |

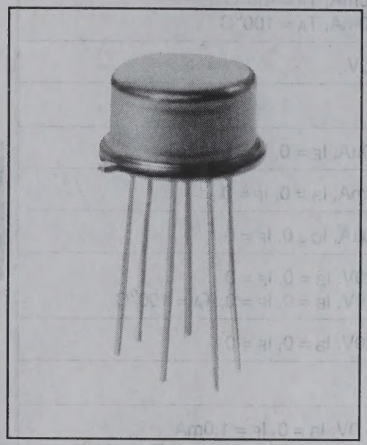


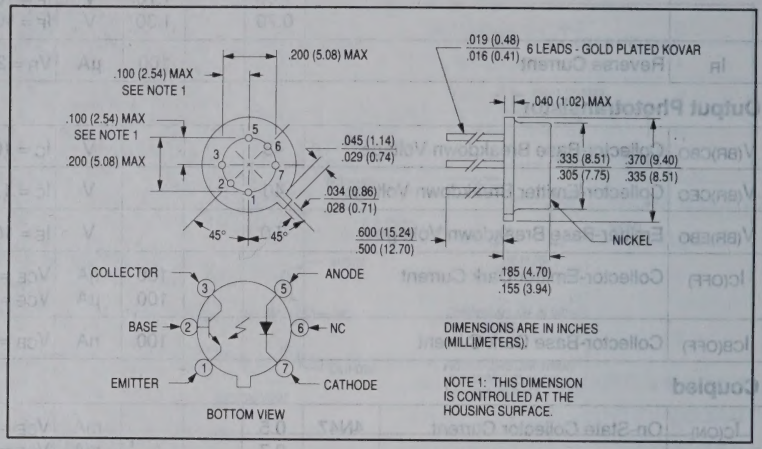
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# Optically Coupled Isolators
## Types JANTX, JANTXV - 4N47, 4N48, 4N49






### Features

- High current transfer ratio
- TO-78 hermetic package
- 1.0 kV electrical isolation
- Base lead provided for conventional transistor biasing
- JANTX qualified per MIL-S-19500/548
- Patent number 4124860

### Description

The JANTX and JANTXV series of the 4N47, 4N48, and 4N49 are JEDEC registered, DESC qualified, optically coupled isolators. High reliability processing on devices is performed in accordance with MIL-S-19500/548.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ± 1.00kVDC(1) |
| Storage Temperature Range | -55°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Soldering Temperature [1/16 in. (1.6mm)) from case for 5 sec. with soldering iron] | 240°C |
| **Input Diode** | |
| Forward DC Current (65°C or below) | 40mA |
| Reverse Voltage | 2.0V |
| Power Dissipation | 60mW(2) |
| **Output Phototransistor** | |
| Continuous Collector Current | 50mA |
| Collector-Base Voltage | 45V |
| Collector-Emitter Voltage | 40V |
| Emitter-Base Voltage | 7.0V |
| Power Dissipation | 300mW(3) |

**Notes:**
(1) Measured with input leads shorted together and output leads shorted together.
(2) Derate linearly 1.0mW/°C above 65°C.
(3) Derate linearly 3.0mW/°C above 25°C.

# Types JANTX, JANTXV - 4N47, 4N48, 4N49

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

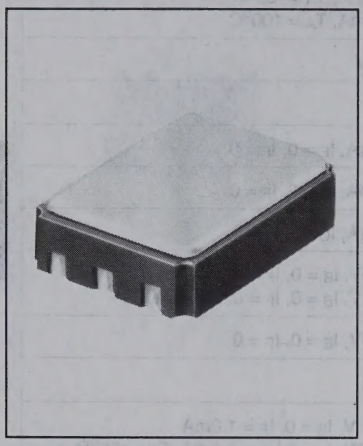
| Symbol | Parameter | Type | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | 0.80 | | 1.50 | V | $I_F$ = 10.0mA |
| | | | 1.00 | | 1.70 | V | $I_F$ = 10.0mA, $T_A$ = -55°C |
| | | | 0.70 | | 1.30 | V | $I_F$ = 10.0mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | | 45 | | | V | $I_C$ = 100µA, $I_E$ = 0, $I_F$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 40 | | | V | $I_C$ = 1.0mA, $I_B$ = 0, $I_F$ = 0 |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | | 7.0 | | | V | $I_E$ = 100µA, $I_C$ = 0, $I_F$ = 0 |
| $I_{C(OFF)}$ | Collector-Emitter Dark Current | | | | 100 | nA | $V_{CE}$ = 20V, $I_B$ = 0, $I_F$ = 0 |
| | | | | | 100 | µA | $V_{CE}$ = 20V, $I_B$ = 0, $I_F$ = 0, $T_A$ = 100°C |
| $I_{CB(OFF)}$ | Collector-Base Dark Current | | | | 10.0 | nA | $V_{CB}$ = 20V, $I_E$ = 0, $I_F$ = 0 |
| **Coupled** | | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 4N47 | 0.5 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 1.0mA |
| | | | 0.7 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA, $T_A$ = -55°C |
| | | | 0.5 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA, $T_A$ = 100°C |
| | | 4N48 | 1.0 | | 5.0 | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 1.0mA |
| | | | 1.4 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA, $T_A$ = -55°C |
| | | | 1.0 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA, $T_A$ = 100°C |
| | | 4N49 | 2.0 | | 10.0 | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 1.0mA |
| | | | 2.8 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA, $T_A$ = -55°C |
| | | | 2.0 | | | mA | $V_{CE}$ = 5.0V, $I_B$ = 0, $I_F$ = 2.0mA, $T_A$ = 100°C |
| $I_{CB(ON)}$ | On-State Collector Base | | 30 | | | µA | $V_{CB}$ = 5.0V, $I_E$ = 0, $I_F$ = 10mA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | 4N47 | | | 0.30 | V | $I_C$ = 0.5mA, $I_B$ = 0, $I_F$ = 2.0mA |
| | | 4N48 | | | 0.30 | V | $I_C$ = 1.0mA, $I_B$ = 0, $I_F$ = 2.0mA |
| | | 4N49 | | | 0.30 | V | $I_C$ = 2.0mA, $I_B$ = 0, $I_F$ = 2.0mA |
| $h_{FE}$ | DC Current Gain | 4N47 | 100 | | | | $V_{CE}$ = 5.0V, $I_C$ = 10.0mA, $I_F$ = 0mA |
| | | 4N48 | 100 | | | | |
| | | 4N49 | 100 | | | | |
| $R_{IO}$ | Resistance (Input-to-Output) | | $10^{11}$ | | | Ω | $V_{I-O}$ = ± 1000Vdc(1) |
| $C_{IO}$ | Capacitance (Input to Output) | | | | 5.0 | pF | $V_{I-O}$ = 0V, f = 1.0MHz(1) |
| $t_r$ | Output Rise Time | 4N47 | | | 20.0 | µs | $V_{CC}$ = 10.0V, $I_F$ = 5.0mA, $R_L$ = 100Ω |
| | | 4N48 | | | 20.0 | µs | |
| | | 4N49 | | | 25.0 | µs | |
| $t_f$ | Output Fall Time | 4N47 | | | 20.0 | µs | |
| | | 4N48 | | | 20.0 | µs | |
| | | 4N49 | | | 25.0 | µs | |

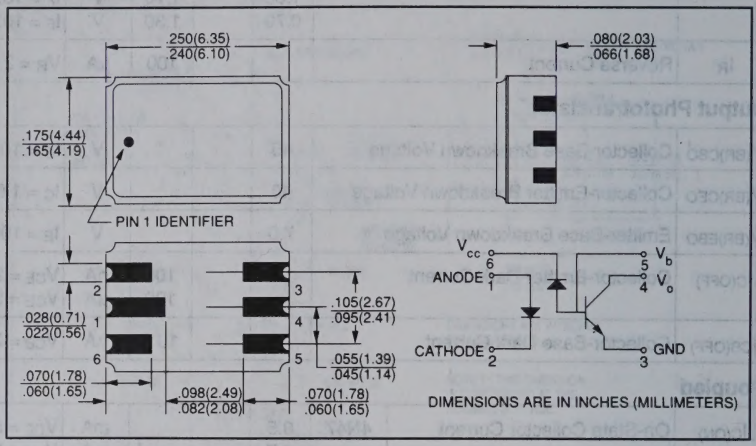


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# High Speed Optocouplers
## Types HCC135, HCC136, HCC135TXV, HCC136TXV






### Features

- High speed - 1 megabit/second
- TTL compatible
- High common mode transient immunity
- Wide bandwidth
- Open collector output
- Hermetic surface mount

### Description

Optek's HCC135 and HCC136 are high speed optocouplers consisting of IR emitters and integrated photodetectors. Their electrical characteristics are such that they can be substituted for 6N135 and 6N136 in applications where hermetic devices are required and board space is at a premium.

The HCC package is a ceramic surface mount leadless chip carrier which is compatible with epoxy and reflow solder mounting technologies.

The HCC135TXV and HCC136TXV are high reliability optocouplers with 100% processeing and Group Testing patterned after MIL-STD-883 Method 5008.

### Absolute Maximum Ratings (No derating required up to 70°C)

| | |
|---|---|
| Storage Temperature | -55°C to +150°C |
| Operating Temperature | -55°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 10 seconds) | 260°C |
| Average Input Current - $I_F$ | 25mA(1) |
| Peak Output Current - $I_F$ (50% duty cycle, 1ms pulse width) | 50mA(2) |
| Peak Transient Input Current - $I_F$ (≤ 1µs pulse width, 300pps) | 1.0A |
| Reverse Input Voltage - $V_R$ | 5.0V |
| Input Power Dissipation | 45mW(3) |
| Average Output Current - $I_O$ | 8.0mA |
| Peak Output Current | 16.0mA |
| Emitter-Base Reverse Voltage | 5.0V |
| Supply and Output Voltage - $V_{CC}$, $V_O$ | -0.5V to 15V |
| Base Current - $I_B$ | 5.0mA |
| Output Power Dissipation | 100mW(4) |

**Caution:** This component is susceptible to damage from electrostatic discharge. Normal static prevention procedures should be used in handling.

**Notes:**
(1) Derate linearly above 70°C free-air temperature at a rate of 0.45mA/°C.
(2) Derate linearly above 70°C free-air temperature at a rate of 0.9mA/°C.
(3) Derate linearly above 70°C free-air temperature at a rate of 0.8mW/°C.
(4) Derate linearly above 70°C free-air temperature at a rate of 1.8mW/°C.
(5) CMH is the maximum allowable dV/dt on the leading edge of a common mode pulse to assure that the output will not switch from high to low.
(6) CML is the maximum negative dV/dt allowable on the trailing edge of a common mode pulse to assure that the output will not switch from low to high.
(7) Test conditions represents 1 TTL unit load with 5.6 kΩ pull-up resistor.
(8) Test conditions represents 1 LSTTL unit load with a 6.1 kΩ pull-up resistor.
(9) Device considered a two-terminal device: pins 1 and 2 shorted together and pins 3, 4, 5 and 6 shorted together.

# Types HCC135, HCC136, HCC135TXV, HCC136TXV

**Electrical Characteristics** (Over recommended temperature $T_A$ = -55°C to 125°C, unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP* | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| CTR | Current Transfer Ratio | HCC135 | 7.0 | 19.0 | | % | $I_F$ = 16.0mA, $V_O$ = 0.40V, |
| | | HCC136 | 19.0 | 25.0 | | % | $V_{CC}$ = 4.5V, $T_A$ = 25°C |
| | | HCC135 | 5.0 | 15.0 | | % | $I_F$ = 16.0mA, $V_O$ = 0.50V |
| | | HCC136 | 15.0 | 23.0 | | % | $V_{CC}$ = 4.5V |
| $V_{OL}$ | Logic Low Output Voltage | HCC135 | | 0.100 | 0.40 | V | $I_F$ = 16.0mA, $I_O$ = 1.10mA, $V_{CC}$ = 4.5V |
| | | HCC136 | | 0.100 | 0.40 | V | $I_F$ = 16.0mA, $I_O$ = 2.4mA, $V_{CC}$ = 4.5V |
| $I_{OH}$ | Logic High Output Current | | | 3.0 | 500 | nA | $I_F$ = 0mA, $V_O$ = $V_{CC}$ = 5.5V, $T_A$ = 25°C |
| | | | | 0.010 | 1.00 | µA | $I_F$ = 0mA, $V_O$ = $V_{CC}$ = 15.0V, $T_A$ = 25°C |
| | | | | | 50 | µA | $I_F$ = 0mA, $V_O$ = $V_{CC}$ = 15.0V |
| $I_{CCL}$ | Logic Low Supply Current | | | 40 | | µA | $I_F$ = 16.0mA, $V_O$ = open, $V_{CC}$ = 15.0V |
| $I_{CCH}$ | Logic High Supply Current | | | 0.020 | 1.00 | µA | $I_F$ = 0mA, $V_O$ = open, $V_{CC}$ = 15.0V, $T_A$ = 25°C |
| | | | | | 2.0 | µA | $I_F$ = 0mA, $V_O$ = open, $V_{CC}$ = 15.0V |
| $V_F$ | Input Forward Voltage | | | 1.50 | 1.70 | V | $I_F$ = 16.0mA, $T_A$ = 25°C |
| $\frac{\Delta V_F}{\Delta T_A}$ | Temperature Coefficient of Forward Voltage | | | -1.80 | | mV/°C | $I_F$ = 16.0mA |
| $BV_R$ | Input Reverse Breakdown Voltage | | 5.0 | | | V | $I_R$ = 10.0µA, $T_A$ = 25°C |
| $C_{IN}$ | Input Capacitance | | | 42 | | pF | f = 1.00MHz, $V_F$ = 0 |
| $I_{IO}$ | Input-Output Insulation Leakage Current | | | | 1.00 | µA | 45% Relative Humidity, t = 5.0 sec, $V_{IO}$ = 1000Vdc, $T_A$ = 25°C (Note 9) |
| $R_{IO}$ | Input-Output Resistance | | | $10^{12}$ | | Ω | $V_{IO}$ = 500 Vdc (Note 9) |
| $C_{IO}$ | Input-Output Capacitance | | | 0.50 | | pF | f = 1.00MHz (Note 9) |
| $h_{FE}$ | Transistor DC Current Gain | | | 150 | | — | $V_O$ = 5.0V, $I_O$ = 3.0mA |

**Switching Specifications** ($T_A$ = 25°C) $V_{CC}$ = 5.0V, $I_F$ = 16.0mA unless otherwise noted

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $t_{PHL}$ | Propagation Delay Time | HCC135 | | 0.50 | 1.50 | µs | $R_L$ = 4.1kΩ (Note 8) |
| | to Logic Low at Output | HCC136 | | 0.20 | 0.80 | µs | $R_L$ = 1.90kΩ (Note 7) |
| $t_{PLH}$ | Propagation Delay Time | HCC135 | | 0.40 | 1.50 | µs | $R_L$ = 4.1kΩ (Note 8) |
| | to Logic High at Output | HCC156 | | 0.30 | 0.80 | µs | $R_L$ = 1.90kΩ (Note 7) |
| $CM_H$ | Common Mode Transient Immunity at Logic High Level Output | HCC135 | | 1000 | | V/µs | $I_F$ = 0mA, $V_{CM}$ = 10.0Vp-p, $R_L$ = 4.1kΩ (Notes 6,8) |
| | | HCC136 | | 1000 | | V/µs | $I_F$ = 0mA, $V_{CM}$ = 10.0Vp-p, $R_L$ = 1.90kΩ (Notes 6, 7) |
| $CM_L$ | Common Mode Transient Immunity at Logic Low Level Output | HCC135 | | -1000 | | V/µs | $V_{CM}$ =10.0Vp-p, $R_L$ =4.1kΩ, (Notes 5, 8) |
| | | HCC136 | | -1000 | | V/µs | $V_{CM}$ =10.0Vp-p, $R_L$ =1.90kΩ, (Notes 5, 7) |

*All typicals at $T_A$ = 25°C and $V_{CC}$ = 5.0V, unless otherwise noted.

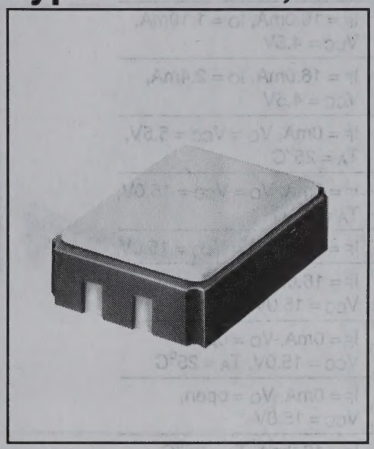


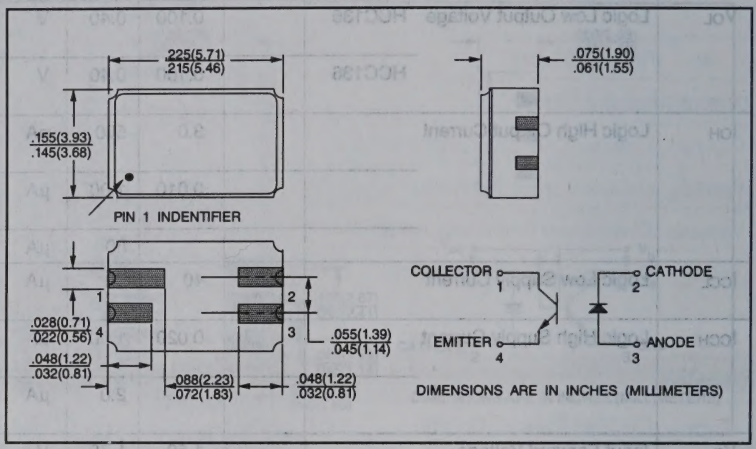
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Surface Mount Optically Coupled Isolator

## Types HCC240, HCC242






### Features

- Surface mountable on ceramic or printed circuit board
- Miniature package saves circuit board area
- Electrical performance similar to 4N22A and 4N24A
- Hermetically sealed
- Screened per MIL-S-19500 TX or TXV equivalent levels on request
- Higher breakdown voltage devices available as the "HV" series

### Description

The HCC240 and HCC242 are optically coupled isolators, consisting of a gallium aluminum arsenide LED and a silicon phototransistor mounted and coupled in a miniature surface mount hermetic leadless chip carrier. The HCC240 and HCC242 are identical except for the DC current transfer ratio. All measurable electrical parameters are identical to the JEDEC registered 4N22A and 4N24A. HCC240HV and HCC242HV series optoisolators are available where higher breakdown voltages are required. These solid state couplers are ideal for designs where board space and device weight are important design considerations.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ±1.0 kVDC(1) |
| Operating Temperature | -55°C to +125°C |
| Storage Temperature | -65°C to +150°C |
| Soldering Temperature (vapor phase reflow for 30 sec.) | 215°C |
| Soldering Temperature (heated collet for 5 sec.) | 260°C |
| **Input Diode** | |
| Forward DC Current (65°C or below) | 40 mA |
| Reverse Voltage | 2.0 V |
| Power Dissipation | 60 mW(2) |
| **Output Phototransistor** | |
| Continuous Collector Current | 50 mA |
| Collector-Emitter Voltage | 30 V(3) |
| Emitter-Collector Voltage | 5.0 V(4) |
| Power Dissipation | 300 mW(5) |

**Notes:**
(1) Measured with inputs shorted together and outputs shorted together.
(2) Derate linearly 1.0 mW/°C above 65°C.
(3) HCC240HV and HCC242HV are available rated at 55 V minimum.
(4) HCC240HV and HCC242HV are available rated at 7.0 V minimum.
(5) Derate linearly 3.0 mW/°C above 25°C.

# Types HCC240, HCC242

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | 0.80 | | 1.30 | V | $I_F$ = 10.0 mA |
| | | | 1.00 | | 1.50 | V | $I_F$ = 10.0 mA, $T_A$ = -55°C |
| | | | 0.70 | | 1.20 | V | $I_F$ = 10.0 mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | | | 100 | μA | $V_R$ = 2.0 V |
| **Output Phototransistor** | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage[3] | | 30 | | | V | $I_C$ = 1.0 mA, $I_F$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage[4] | | 5.0 | | | V | $I_E$ = 100 μA, $I_F$ = 0 |
| $I_{C(OFF)}$ | Collector-Emitter Dark Current | | | | 100 | nA | $V_{CE}$ = 20 V, $I_F$ = 0 |
| | | | | | 100 | μA | $V_{CE}$ = 20 V, $I_F$ = 0, $T_A$ = 100°C |
| **Coupled** | | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | HCC240 | 0.15 | | | mA | $V_{CE}$ = 5.0 V, $I_F$ = 2.0 mA |
| | | | 2.5 | 6.0 | | mA | $V_{CE}$ = 5.0 V, $I_F$ = 10.0 mA |
| | | | 1.0 | | | mA | $V_{CE}$ = 5.0 V, $I_F$ = 10.0 mA, $T_A$ = -55°C |
| | | | 1.0 | | | mA | $V_{CE}$ = 5.0 V, $I_F$ = 10.0 mA, $T_A$ = 100°C |
| | | HCC242 | 0.40 | | | mA | $V_{CE}$ = 5.0 V, $I_F$ = 2.0 mA |
| | | | 10.0 | 15.0 | | mA | $V_{CE}$ = 5.0 V, $I_F$ = 10.0 mA |
| | | | 4.0 | | | mA | $V_{CE}$ = 5.0 V, $I_F$ = 10.0 mA, $T_A$ = -55°C |
| | | | 4.0 | | | mA | $V_{CE}$ = 5.0 V, $I_F$ = 10.0 mA, $T_A$ = 100°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | HCC240 | | | 0.30 | V | $I_C$ = 2.5 mA, $I_F$ = 20.0 mA |
| | | HCC242 | | | 0.30 | V | $I_C$ = 10.0 mA, $I_F$ = 20.0 mA |
| $R_{I-O}$ | Resistance (Input to Output) | | $10^{11}$ | | | Ω | $V_{I-O}$ = ±1000 Vdc[1] |
| $C_{I-O}$ | Capacitance (Input to Output) | | | | 5.0 | pF | $V_{I-O}$ = 0.0 V, f = 1.0 MHz[1] |
| $t_r$ | Output Rise Time | HCC240 | | | 15.0 | μs | $V_{CC}$ = 10.0 V, $I_F$ = 10.0 mA, |
| | | HCC242 | | | 20.0 | μs | $R_L$ = 100 Ω |
| $t_f$ | Output Fall Time | HCC240 | | | 15.0 | μs | $V_{CC}$ = 10.0 V, $I_F$ = 10.0 mA, |
| | | HCC242 | | | 20.0 | μs | $R_L$ = 100 Ω |

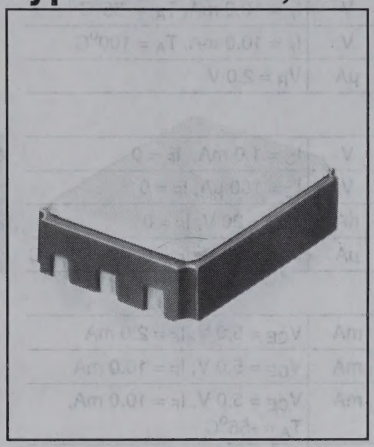


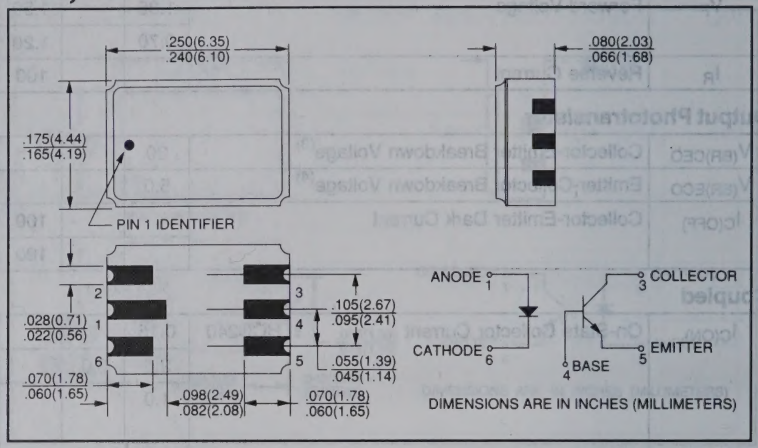
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Surface Mount Optically Coupled Isolator

## Types HCC247, HCC248, HCC249






### Features

- Surface mountable on ceramic or printed circuit board
- Miniature package saves circuit board area
- Electrical performance similar to 4N47, 4N48, and 4N49
- Hermetically sealed
- Base pad provided for conventional transistor biasing
- Screened per MIL-S-19500 TX or TXV equivalent levels on request
- Higher breakdown voltage devices available as the "HV" series

### Description

The HCC247, HCC248, and HCC249 are optically coupled isolators, consisting of a gallium aluminum arsenide LED and a silicon phototransistor mounted and coupled in a miniature surface mount hermetic leadless chip carrier. All electrical characteristics are identical to the JEDEC registered 4N47, 4N48, and 4N49. HCC247HV, HCC248HV, and HCC249HV series optoisolators are available where higher breakdown voltages are required.

These solid state couplers are ideal for designs where board space and device weight are important design considerations.

### Absolute Maximum Ratings ($T_A = 25^{\circ}C$ unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ±1.0 kVDC(1) |
| Operating Temperature | -55°C to +125°C |
| Storage Temperature | -65°C to +150°C |
| Soldering Temperature (vapor phase reflow for 30 sec.) | 215°C |
| Soldering Temperature (heated collet for 5 sec.) | 260°C |
| **Input Diode** | |
| Forward DC Current (65°C or below) | 40 mA |
| Reverse Voltage | 3.0 V |
| Power Dissipation | 60 mW(2) |
| **Output Phototransistor** | |
| Continuous Collector Current | 50 mA |
| Collector-Base Voltage | 45 V(3) |
| Collector-Emitter Voltage | 40 V(3) |
| Emitter-Base Voltage | 7.0 V |
| Power Dissipation | 300 mW(4) |

**Notes:**
(1) Measured with inputs shorted together and outputs shorted together.
(2) Derate linearly 1.0 mW/°C above 65°C.
(3) HCC247HV, HCC248HV, and HCC249HV are available rated at 55 V minimum.
(4) Derate linearly 3.0 mW/°C above 25°C.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types HCC247, HCC248, HCC249

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| | | | 0.80 | | 1.50 | V | $I_F$ = 10.0 mA |
| $V_F$ | Forward Voltage | | 1.00 | | 1.70 | V | $I_F$ = 10.0 mA, $T_A$ = -55°C |
| | | | 0.70 | | 1.30 | V | $I_F$ = 10.0 mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 3.0 V |
| **Output Phototransistor** | | | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage[3] | | 45 | | | V | $I_C$ = 100 µA, $I_E$ = 0, $I_F$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage[3] | | 40 | | | V | $I_C$ = 1.0 mA, $I_B$ = 0, $I_F$ = 0 |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | | 7.0 | | | V | $I_E$ = 100 µA, $I_C$ = 0, $I_F$ = 0 |
| $I_{C(OFF)}$ | Collector-Emitter Dark Current | | | | 100 | nA | $V_{CE}$ = 20 V, $I_B$ = 0, $I_F$ = 0 |
| | | | | | 100 | µA | $V_{CE}$ = 20 V, $I_B$ = 0, $I_F$ = 0, $T_A$ = 100°C |
| $I_{CB(OFF)}$ | Collector-Base Dark Current | | | | 10.0 | nA | $V_{CB}$ = 20 V, $I_E$ = 0, $I_F$ = 0 |
| **Coupled** | | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | HCC247 | 0.5 | | | mA | $V_{CE}$ = 5.0 V, $I_B$ = 0, $I_F$ = 1.0 mA |
| | | | 0.7 | | | mA | $V_{CE}$ = 5.0 V, $I_B$ = 0, $I_F$ = 2.0 mA , $T_A$ = -55°C |
| | | | 0.5 | | | mA | $V_{CE}$ = 5.0 V, $I_B$ = 0, $I_F$ = 2.0 mA, $T_A$ = 100°C |
| | | HCC248 | 1.0 | | 5.0 | mA | $V_{CE}$ = 5.0 V, $I_B$ = 0, $I_F$ = 1.0 mA |
| | | | 1.4 | | | mA | $V_{CE}$ = 5.0 V, $I_B$ = 0, $I_F$ = 2.0 mA, $T_A$ = -55°C |
| | | | 1.0 | | | mA | $V_{CE}$ = 5.0 V, $I_B$ = 0, $I_F$ = 2.0 mA, $T_A$ = 100°C |
| | | HCC249 | 2.0 | | 10.0 | mA | $V_{CE}$ = 5.0 V, $I_B$ = 0, $I_F$ = 1.0 mA |
| | | | 2.8 | | | mA | $V_{CE}$ = 5.0 V, $I_B$ = 0, $I_F$ = 2.0 mA, $T_A$ = -55°C |
| | | | 2.0 | | | mA | $V_{CE}$ = 5.0 V, $I_B$ = 0, $I_F$ = 2.0 mA, $T_A$ = 100°C |
| $I_{CB(ON)}$ | On-State Collector-Base Current | | 30 | | | µA | $V_{CB}$ = 5.0 V, $I_E$ = 0, $I_F$ = 10 mA |
| | | HCC247 | | | 0.30 | V | $I_C$ = 0.5 mA, $I_B$ = 0, $I_F$ = 2.0 mA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | HCC248 | | | 0.30 | V | $I_C$ = 1.0 mA, $I_B$ = 0, $I_F$ = 2.0 mA |
| | | HCC249 | | | 0.30 | V | $I_C$ = 2.0 mA, $I_B$ = 0, $I_F$ = 2.0 mA |
| $R_{I-O}$ | Resistance (Input to Output) | | $10^{11}$ | | | Ω | $V_{I-O}$ = ±1000 Vdc[1] |
| $C_{I-O}$ | Capacitance (Input to Output) | | | | 5.0 | pF | $V_{I-O}$ = 0.0 V, f = 1.0 MHz[1] |
| | | HCC247 | | | 20.0 | µs | $V_{CC}$ = 10.0 V, |
| $t_r$ | Output Rise Time | HCC248 | | | 20.0 | µs | $I_F$ = 5.0 mA, |
| | | HCC249 | | | 25.0 | µs | $R_L$ = 100 Ω |
| | | HCC247 | | | 20.0 | µs | $V_{CC}$ = 10.0 V, |
| $t_f$ | Output Fall Time | HCC248 | | | 20.0 | µs | $I_F$ = 5.0 mA, |
| | | HCC249 | | | 25.0 | µs | $R_L$ = 100 Ω |

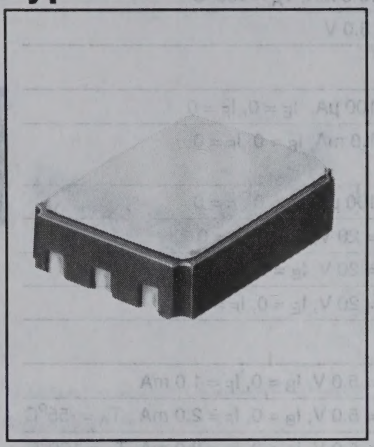


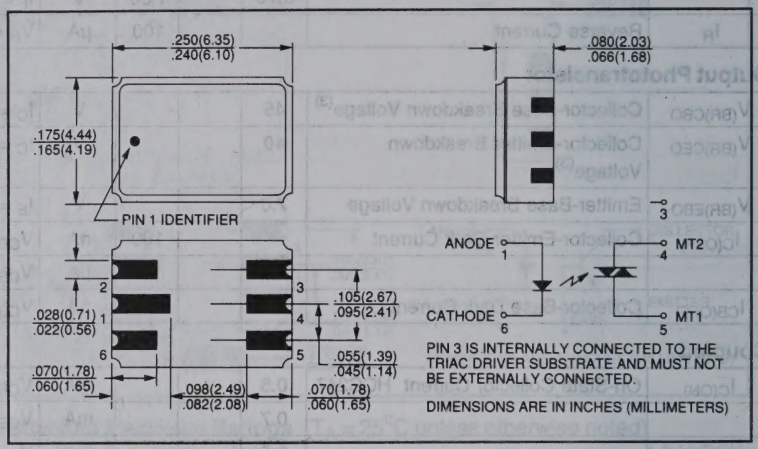
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Zero Voltage Crossing Optically Coupled Triac Driver

## Type HCC340






### Features

- For 220 VAC operation
- 1500 VDC electrical isolation
- Zero voltage crossing for reduced EMI, line noise, and improved static dV/dt
- Surface mountable on ceramic or printed circuit board
- Miniature package saves circuit board area
- Hermetically sealed package

### Description

The HCC340 consists of a gallium aluminum arsenide infrared emitting diode and a monolithic integrated circuit containing a photodiode and a zero voltage bidirectional triac driver mounted in a miniature six pin hermetic leadless chip carrier. The device is for low power DC controlling of power triacs which in turn control resistive, inductive, or capacitive loads powered from 220 VAC. Zero voltage crossing ensures that the device will not turn on until the line voltage reduces to 15 volts, typical.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ±1.5 kVDC(1) |
| Operating Temperature | -55°C to +125°C |
| Storage Temperature | -65°C to +150°C |
| Soldering Temperature (vapor phase reflow for 30 sec.) | 215°C |
| Soldering Temperature (heated collet for 5 sec.) | 260°C |
| **Input Diode** | |
| Forward DC Current (65°C or below) | 40 mA |
| Reverse Voltage | 3.0 V |
| Power Dissipation | 60 mW(2) |
| **Output Photosensor** | |
| Off-State Terminal Voltage | 400 V |
| On-State RMS Current (Full Cycle, 50-60 Hz, $T_A$ = 25°C) | 100 mA |
| On-State RMS Current (Full Cycle, 50-60 Hz, $T_A$ = 70°C) | 50 mA |
| Peak Non-Repetitive Surge Current (PW = 10 ms, duty cycle = 10%) | 1.20 A |
| Power Dissipation | 300 mW(3) |

**Notes:**
(1) Measured with inputs shorted together and outputs shorted together.
(2) Derate linearly 1.0 mW/°C above 65°C.
(3) Derate linearly 3.0 mW/°C above 25°C.

# Type HCC340

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

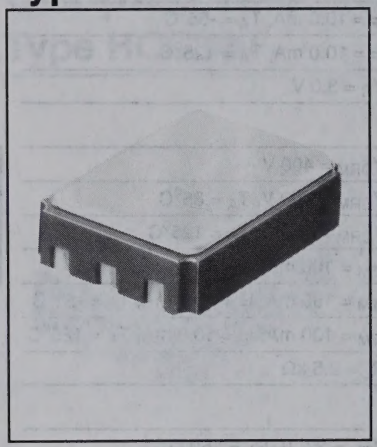
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | 1.20 | | 1.60 | V | $I_F$ = 10.0 mA |
| | | 1.00 | | 1.80 | V | $I_F$ = 10.0 mA, $T_A$ = -55°C |
| | | 0.80 | | 1.40 | V | $I_F$ = 10.0 mA, $T_A$ = 125°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 3.0 V |
| **Output Phototransistor** | | | | | | |
| $I_{DRM}$ | Peak Blocking Current, Either Direction | | 10.0 | 100 | nA | $V_{DRM}$ = 400 V |
| | | | | 6.0 | µA | $V_{DRM}$ = 400 V, $T_A$ = 85°C |
| | | | | 6.0 | µA | $V_{DRM}$ = 300 V, $T_A$ = 125°C |
| $V_{TM}$ | Peak On-State Voltage, Either Direction | | 1.75 | 3.0 | V | $I_{TM}$ = 100 mA, $I_F$ = 10.0 mA |
| | | | | 3.0 | V | $I_{TM}$ = 100 mA, $I_F$ = 10.0 mA, $T_A$ = -55°C |
| | | | | 5.0 | V | $I_{TM}$ = 100 mA, $I_F$ = 10.0 mA, $T_A$ = 125°C |
| dV/dt | Critical Rate of Rise of Off-State Voltage | 100 | | | V/µs | $R_L$ = 2.5 kΩ |
| **Coupled** | | | | | | |
| $I_{FT}$ | LED Trigger Current Required to Latch | | | 10.0 | mA | $V_{TM}$ = 3.0 V, $R_L$ = 150 Ω |
| | | | | 15.0 | mA | $V_{TM}$ = 5.0 V, $R_L$ = 150 Ω, $T_A$ = -55°C |
| | | | | 20.0 | mA | $V_{TM}$ = 5.0 V, $R_L$ = 150 Ω, $T_A$ = 125°C |
| $I_H$ | Holding Current, Either Direction | | 200 | | µA | |
| $V_{ISO}$ | Isolation Voltage | 1500 | | | VDC | See Note (1) |
| $V_{I(TH)}$ | Zero Voltage Crossing Inhibit Voltage Threshold | | | 40 | V | $I_{FT}$ = 10.0 mA |
| | | | | 40 | V | $I_{FT}$ = 10.0 mA, $T_A$ = -55°C |
| | | | | 40 | V | $I_{FT}$ = 10.0 mA, $T_A$ = 125°C |
| $I_{R(I)}$ | Leakage Current in Inhibit State | | | 300 | µA | $I_{FT}$ = 10.0 mA, $V_{MT}$ = 400 V |
| | | | | 600 | µA | $I_{FT}$ = 10.0 mA, $V_{MT}$ = 400 V, $T_A$ = -55°C |
| | | | | 300 | µA | $I_{FT}$ = 10.0 mA, $V_{MT}$ = 300 V, $T_A$ = 125°C |

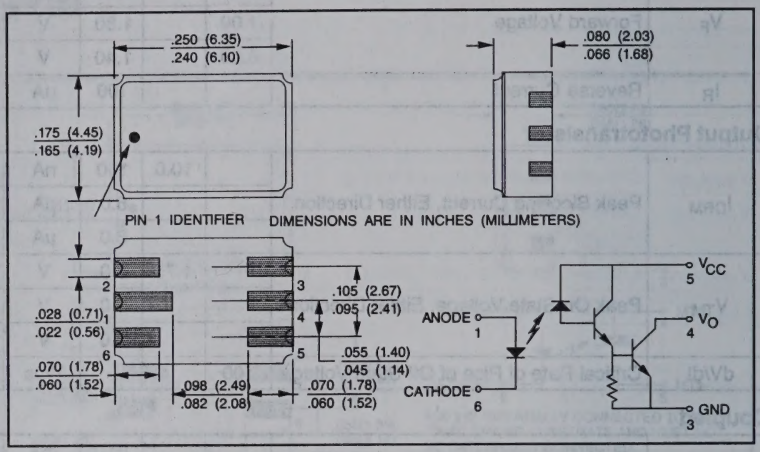


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Surface Mount Optically Coupled Isolator
## Type HCC640






### Features

- Surface mountable on ceramic or PC board
- 6N140A operating compatibility
- Key parameters guaranteed over -55°C to 125°C ambient temperature range
- Hermetically sealed
- Low power consumption
- High current transfer ratio
- Low input current requirement
- 1500 VDC isolation voltage

### Description

The HCC640 is a hermetically sealed, ceramic surface-mount optocoupler, consisting of a GaAlAs IRED coupled to an integrated high gain photodiode. The HCC640 is electrically equivalent to a single channel of the Optek's HDA140A (6N140A) quad-channel device. The high gain, open-collector output provides both lower output saturation voltage and faster switching speeds than possible with standard photodarlington optocouplers. The high current transfer ratio at very low input currents makes the HCC640 ideal for use in MOS, CMOS and low power logic interfacing. The HCC640 is capable of operation and storage over the full military temperature range and can be supplied with full processing per Optek's Military screening procedure (based on MIL-STD-883) upon request.

### Absolute Maximum Ratings ($T_A = 25°C$ unless otherwise noted)

| | |
|---|---|
| Operating Temperature | -55°C to +125°C |
| Storage Temperature | -65°C to +150°C |
| Soldering Temperature (vapor phase reflow for 30 sec.) | 215°C |
| Soldering Temperature (heated collet for 5 sec.) | 260°C |

**Input Diode**

| | |
|---|---|
| Peak Input Current (≤1 ms duration, 500 pps) | 20 mA |
| Average Input Current, $I_F$ (each channel) | 10.0 mA(1) |
| Reverse Input Voltage, $V_R$ | 5.0 V |

**Output Photodetector**

| | |
|---|---|
| Output Current, $I_O$ | 40 mA |
| Output Voltage, $V_O$ | -0.5 to 20 V(2) |
| Supply Voltage, $V_{CC}$ | -0.5 to 20 V(2) |
| Output Power Dissipation | 50 mW(3) |

**Notes:**

(1) Derate $I_F$ at 0.66 mA/°C above 110°C.

(2) Pin 3 (Ground) should be the most negative voltage at the detector side. Keeping $V_{CC}$ as low as possible, but greater than 2.0 volts, will provide lowest total $I_{OH}$ over temperature.

(3) Output power is collector output power plus one half of the total supply power. Derate at 3.33 mW/°C above 110°C.

# Type HCC640

**Electrical Characteristics** ($T_A$ = -55°C to 125°C unless otherwise noted)

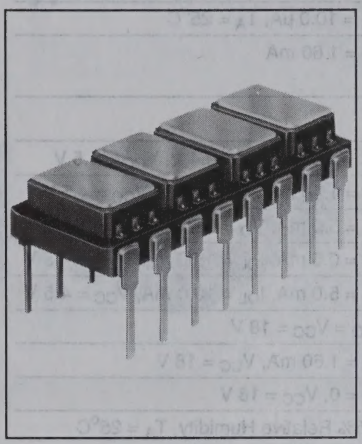
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | 1.70 | V | $I_F$ = 1.60 mA, $T_A$ = 25°C |
| $BV_R$ | Reverse Breakdown Voltage | 5.0 | | | V | $I_R$ = 10.0 µA, $T_A$ = 25°C |
| $\frac{\Delta V_F}{\Delta T_A}$ | Temperature Coefficient of Forward Voltage | | -1.80 | | mV/°C | $I_F$ = 1.60 mA |
| **Coupled** | | | | | | |
| CTR | Current Transfer Ratio | 300 | 1500 | | % | $I_F$ = 0.5 mA, $V_O$ = 0.4 V, $V_{CC}$ = 4.5 V |
| | | 300 | 1000 | | % | $I_F$ = 1.60 mA, $V_O$ = 0.4 V, $V_{CC}$ = 4.5 V |
| | | 200 | 500 | | % | $I_F$ = 5.0 mA, $V_O$ = 0.4 V, $V_{CC}$ = 4.5 V |
| $V_{OL}$ | Logic Low Output Voltage | | 0.1 | 0.4 | V | $I_F$ = 0.5 mA, $I_{OL}$ = 1.50 mA, $V_{CC}$ = 4.5 V |
| $V_{OL}$ | Logic Low Output Voltage | | 0.2 | 0.4 | V | $I_F$ = 5.0 mA, $I_{OL}$ = 10.0 mA, $V_{CC}$ = 4.5 V |
| $I_{OH}$ | Logic High Output Current | | 0.001 | 250 | µA | $V_O$ = $V_{CC}$ = 18 V |
| $I_{CCL}$ | Logic Low Supply Current | | 0.40 | 1.0 | mA | $I_F$ = 1.60 mA, $V_{CC}$ = 18 V |
| $I_{CCH}$ | Logic High Supply Current | | 0.001 | 10 | µA | $I_F$ = 0, $V_{CC}$ = 18 V |
| $I_{I-O}$ | Input-Output Insulation Leakage Current | | | 1.0 | µA | 45% Relative Humidity, $T_A$ = 25°C<br>t = 5 sec, $V_{I-O}$ = 1500 Vdc |
| $R_{I-O}$ | Resistance (Input-Output) | | $10^{12}$ | | Ω | $V_{I-O}$ = 500 Vdc |
| $C_{I-O}$ | Capacitance (Input-Outout) | | 1.5 | | pF | f = 1.0 MHz, $T_A$ = 25°C |
| $C_{I-I}$ | Capacitance (Input-Input) | | 1.0 | | pF | f = 1.0 MHz, $T_A$ = 25°C |
| $C_{IN}$ | Input Capacitance | | 60 | | pF | f = 1.0 MHz, $V_F$ = 0, $T_A$ = 25°C |
| $I_{I-I}$ | Input-Input Insulation Leakage Current | | 0.5 | | nA | 45% Relative Humidity, $V_{I-I}$ = 500 V<br>$T_A$ = 25°C, t = 5 sec |
| $R_{I-I}$ | Resistance (Input-Input) | | $10^{12}$ | | Ω | $V_{I-I}$ = 500 V, $T_A$ = 25°C |
| **Switching Specification** ($T_A$ = 25°C) | | | | | | |
| $t_{PLH}$ | Propagation Delay Time | | 6.0 | 60 | µs | $I_F$ = 0.5 mA, $R_L$ = 4.7 kΩ, $V_{CC}$ = 5.0 V |
| | To Logic High At Output | | 4.0 | 20 | µs | $I_F$ = 5.0 mA, $R_L$ = 680 Ω, $V_{CC}$ = 5.0 V |
| $t_{PHL}$ | Propagation Delay Time | | 30 | 100 | µs | $I_F$ = 0.5 mA, $R_L$ = 4.7 kΩ, $V_{CC}$ = 5.0 V |
| | To Logic Low At Output | | 2.0 | 5.0 | µs | $I_F$ = 5.0 mA, $R_L$ = 680 Ω, $V_{CC}$ = 5.0 V |
| $CM_H$ | Common Mode Transient Immunity At Logic High Level Level Output | 500 | 1000 | | V/µs | $I_F$ = 0, $R_L$ = 1.5 kΩ<br>$\|V_{CM}\|$ = 50 $V_{p-p'}$<br>$V_{CC}$ = 5.0 V |
| $CM_L$ | Common Mode Transient Immunity At Logic Low Level Level Output | -500 | -1000 | | V/µs | $I_F$ = 1.60 mA, $R_L$ = 1.5 kΩ<br>$\|V_{CM}\|$ = 50 $V_{p-p'}$<br>$V_{CC}$ = 5.0 V |

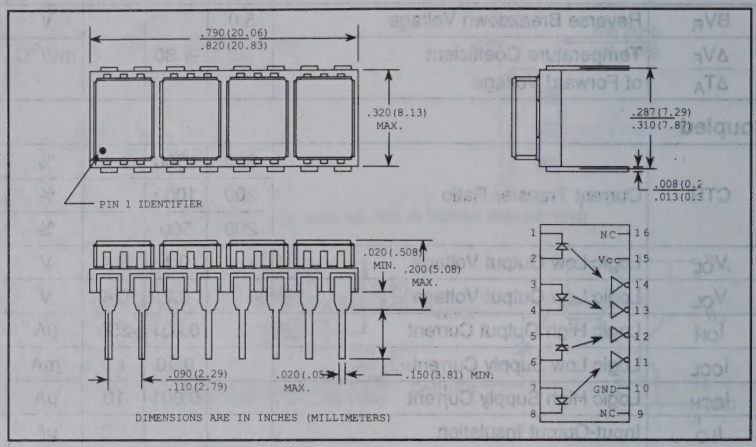


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Four Channel Low Input Current Optocoupler
## Type HDA140A






### Functions

- Key parameters guaranteed over temperature
- Hermetically sealed
- High density packaging
- Low power consumption
- High current transfer ratio
- Low input current requirement

### Description

The HDA140A consists of four ceramic surface mount optocouplers attached to a dual in-line leaded mother board. This package is superior to single cavity construction because it eliminates any possibility of crosstalk between channels while still meeting the 6N140A JEDEC physical and electrical requirements. The photodiode and the first stage transistor of each channel are connected in common, permitting lower output saturation voltage and higher speed operation than possible with conventional photodarlington optocouplers.

Custom tested HDA140A devices for programs requiring special military processing can be supplied in accordance with Optek's own special environmental, electrical screening and quality conformance testing.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Operating Temperature | -55°C to +150°C |
| Storage Temperature | -65°C to +150°C |
| Lead Solder Temperature (1.6mm below seating plane for 10 sec.) | 260°C |
| **Input Diode** | |
| Peak Input Current (each channel, ≤ 1ms duration, 500 pps) | 20mA |
| Average Input Current, $I_F$ (each channel) | 10.0mA(1) |
| Reverse Input Voltage, $V_R$ (each channel) | 5.0V |
| **Output Photodetector** | |
| Output Current, $I_O$ (each channel) | 40mA |
| Output Voltage, $V_O$ (each channel) | -0.5 to 20V(2) |
| Supply Voltage, $V_{CC}$ | -0.5 to 20V(2) |
| Output Power Dissipation (each channel) | 50mW(3) |

**Notes:**

(1) Derate $I_F$ at 0.25mA/°C above 110°C.

(2) Pin 10 (Ground) should be most negative voltage at the detector side. Keeping $V_{CC}$ as low as possible, greater than 2.0 volts, will provide the lowest total $I_{OH}$ over temperature.

(3) Output power is collector output power plus one fourth of the total supply power. Derate at 1.25mW/°C above 110°C.

(4) $I_{OHX}$ is leakage current resulting from channel to channel optical crosstalk. $I_F$ = 2.0μA for channel under test. For all other channels $I_F$ = 10.0mA.

# Type HDA140A

**Electrical Characteristics ($T_A$ = -55°C to 125°C, unless otherwise noted)**

| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$* | Forward Voltage | | | 1.70 | V | $I_F$ = 1.60mA, $T_A$ = 25°C |
| $BV_R$* | Reverse Breakdown Voltage | 5.0 | | | V | $I_R$ = 10.0µA, $T_A$ = 25°C |
| $\frac{\Delta V_F}{\Delta T_A}$ | Temperature Coefficient of Forward Voltage | | -1.80 | | mV/°C | $I_F$ = 1.60mA |
| **Coupled** | | | | | | |
| CTR* | Current Transfer Ratio | 300 | 1500 | | % | $I_F$ = 0.50mA, $V_O$ = 0.4V, $V_{CC}$ = 4.5V |
| | | 300 | 1000 | | % | $I_F$ = 1.60mA, $V_O$ = 0.4V, $V_{CC}$ = 4.5V |
| | | 200 | 500 | | % | $I_F$ = 5.0mA, $V_O$ = 0.4V, $V_{CC}$ = 4.5V |
| $V_{OL}$ | Logic Low Output Voltage | | 0.1 | 0.4 | V | $I_F$ = 0.50mA, $I_{OL}$ = 1.50mA, $V_{CC}$ = 4.5V |
| $V_{OL}$ | Logic Low Output Voltage | | 0.2 | 0.4 | V | $I_{F = 5.0mA}$, $I_{OL}$ = 10.0mA, $V_{CC}$ = 4.5V |
| $I_{OHX}$ | Logic High Output Current | | .001 | 250 | µA | $I_F$ = 2.0mA (channel under test) |
| $I_{OH}$* | Logic High Output Current | | .001 | 250 | µA | $V_O$ = $V_{CC}$ = 18V (see note 4) |
| $I_{CCL}$* | Logic Low Supply Current | | 1.70 | 4.0 | mA | $I_{F1}$ = $I_{F2}$ = $I_{F3}$ = $I_{F4}$ =1.60mA, $V_{CC}$ = 18V |
| $I_{CCH}$* | Logic High Supply Current | | .001 | 40 | µA | $I_{F1}$ = $I_{F2}$ = $I_{F3}$ = $I_{F4}$ = 0mA, $V_{CC}$ = 18V |
| $I_{I-O}$* | Input-Output Insulation Leakage Current | | | 1.0 | µA | 45% Relative Humidity, $T_A$ = 25°C, t = 5sec, $V_{I-O}$ = 1500VDC |
| $R_{I-O}$ | Resistance (input-output) | | $10^{12}$ | | Ω | $V_{I-O}$ = 500VDC |
| $C_{I-O}$ | Capacitance (input-output) | | 1.50 | | pF | f = 1.00MHz, $T_A$ = 25°C |
| $C_{I-I}$ | Capacitance (input-input) | | 1.00 | | pF | f = 1.00MHz, $T_A$ = 25°C |
| $C_{IN}$ | Input Capacitance | | 60 | | pF | f = 1.00MHz, $V_F$ = 0, $T_A$ = 25°C |
| $I_{I-I}$ | Input-Input Insulation Leakage Current | | 0.50 | | nA | 45% Relative Humidity, $V_H$ = 500V, $T_A$ = 25°C, t = 5 sec |
| $R_{I-I}$ | Resistance (input-input) | | $10^{12}$ | | Ω | $V_{I-I}$ = 500V, $T_A$ = 25°C |
| **Switching Specification ($T_A$ = 25°C)** | | | | | | |
| $t_{PLH}$* | Propagation Delay Time to Logic High at Output | | 6.0 | 60 | µs | $I_F$ = 0.50mA, $R_L$ = 4.7kΩ, $V_{CC}$ = 5.0V |
| | | | 4.0 | 20 | µs | $I_F$ = 5.0mA, $R_L$ = 680kΩ, $V_{CC}$ = 5.0V |
| $t_{PHL}$* | Propagation Delay Time to Logic Low at Output | | 30 | 100 | µs | $I_F$ = 0.50mA, $R_L$ = 4.7kΩ, $V_{CC}$ = 5.0V |
| | | | 2.0 | 5.0 | µs | $I_F$ = 5.0mA, $R_L$ = 680kΩ, $V_{CC}$ = 5.0V |
| $CM_H$ | Common Mode Transient Immunity at Logic High Level Level Output | 500 | 1000 | | V/µs | $I_F$ = 0, $R_L$ = 1.5kΩ, $\|V_{CM}\|$ = $50V_{p-p}$, $V_{CC}$ = 5.0V |
| $CM_L$ | Common Mode Transient Immunity at Logic Low Level Level Output | -500 | -1000 | | V/µs | $I_F$ = 1.60mA, $R_L$ = 1.5kΩ, $\|V_{CM}\|$ = $50V_{p-p}$, $V_{CC}$ = 5.0V |

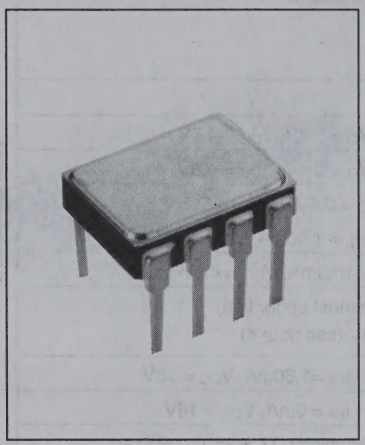
*JEDEC Registered Data

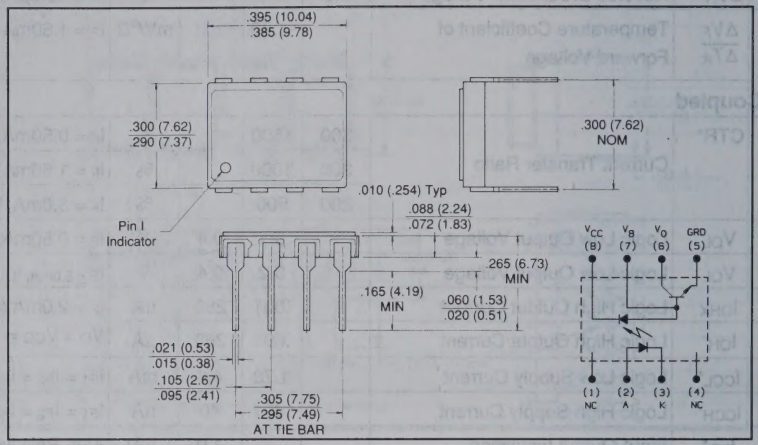
HI REL OPTO COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# High Speed Optocouplers
## Types HDC135, HDC136, HDC135TXV, HDC136TXV






### Features

- High speed - 1 megabit/second
- TTL compatible
- High common mode transient immunity
- Wide bandwidth
- Open collector output

### Description

Optek's HDC135 and HDC136 are high speed optocouplers, consisting of IR emitters and integrated photodetectors in hermetic side brazed dual-in-line 8 pin packages. Electrical characteristics are similar to the 6N135 and 6N136 optocouplers but with full military temperature range operation.

The HDC135TXV and HDC136TXV are high reliability optocouplers with 100% processing and Group Testing patterned after MIL-STD-883 Method 5008.

### Absolute Maximum Ratings (No derating required up to 70°C)

| | |
|---|---|
| Storage Temperature | -55°C to +150°C |
| Operating Temperature | -55°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 10 seconds) | 260°C |
| Average Input Current - $I_F$ | 25mA(1) |
| Peak Output Current - $I_F$ (50% duty cycle, 1ms pulse width) | 50mA(2) |
| Peak Transient Input Current - $I_F$ (≤ 1µs pulse width, 300pps) | 1.0A |
| Reverse Input Voltage - $V_R$ | 5.0V |
| Input Power Dissipation | 45mW(3) |
| Average Output Current - $I_O$ | 8.0mA |
| Peak Output Current | 16.0mA |
| Emitter-Base Reverse Voltage | 5.0V |
| Supply and Output Voltage - $V_{CC}$, $V_O$ | -0.5V to 15V |
| Base Current - $I_B$ | 5.0mA |
| Output Power Dissipation | 100mW(4) |

**Caution:** This component is susceptible to damage from electrostatic discharge. Normal static prevention procedures should be used in handling.

**Notes:**

(1) Derate linearly above 70°C free-air temperature at a rate of 0.45mA/°C.
(2) Derate linearly above 70°C free-air temperature at a rate of 0.9mA/°C.
(3) Derate linearly above 70°C free-air temperature at a rate of 0.8mW/°C.
(4) Derate linearly above 70°C free-air temperature at a rate of 1.8mW/°C.
(5) CMH is the maximum allowable dV/dt on the leading edge of a common mode pulse to assure that the output will not switch from high to low.
(6) CML is the maximum negative dV/dt allowable on the trailing edge of a common mode pulse to assure that the output will not switch from low to high.
(7) Test conditions represents 1 TTL unit load with 5.6 kΩ pull-up resistor.
(8) Test conditions represents 1 LSTTL unit load with a 6.1 kΩ pull-up resistor.
(9) Device considered a two-terminal device: pins 1, 2, 3 and 4 shorted together and pins 5, 6, 7 and 8 shorted together.

# Types HDC135, HDC136, HDC135TXV, HDC136TXV

**Electrical Characteristics** (Over recommended temperature $T_A$ = -55°C to 125°C, unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP* | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| CTR | Current Transfer Ratio | HDC135 | 7.0 | 19.0 | | % | $I_F$ = 16.0mA, $V_O$ = 0.40V, |
| | | HDC136 | 19.0 | 25.0 | | % | $V_{CC}$ = 4.5V, $T_A$ = 25°C |
| | | HDC135 | 5.0 | 15.0 | | % | $I_F$ = 16.0mA, $V_O$ = 0.50V |
| | | HDC136 | 15.0 | 23.0 | | % | $V_{CC}$ = 4.5V |
| $V_{OL}$ | Logic Low Output Voltage | HDC135 | | 0.100 | 0.40 | V | $I_F$ = 16.0mA, $I_O$ = 1.10mA, $V_{CC}$ = 4.5V |
| | | HDC136 | | 0.100 | 0.40 | V | $I_F$ = 16.0mA, $I_O$ = 2.4mA, $V_{CC}$ = 4.5V |
| $I_{OH}$ | Logic High Output Current | | | 3.0 | 500 | nA | $I_F$ = 0mA, $V_O$ = $V_{CC}$ = 5.5V, $T_A$ = 25°C |
| | | | | 0.010 | 1.00 | µA | $I_F$ = 0mA, $V_O$ = $V_{CC}$ = 15.0V, $T_A$ = 25°C |
| | | | | | 50 | µA | $I_F$ = 0mA, $V_O$ = $V_{CC}$ = 15.0V |
| $I_{CCL}$ | Logic Low Supply Current | | | 40 | | µA | $I_F$ = 16.0mA, $V_O$ = Open, $V_{CC}$ = 15.0V |
| $I_{CCH}$ | Logic High Supply Current | | | 0.020 | 1.00 | µA | $I_F$ = 0mA, $V_O$ = open, $V_{CC}$ = 15.0V, $T_A$ = 25°C |
| | | | | | 2.0 | µA | $I_F$ = 0mA, $V_O$ = Open, $V_{CC}$ = 15.0V |
| $V_F$ | Input Forward Voltage | | | 1.50 | 1.70 | V | $I_F$ = 16.0mA, $T_A$ = 25°C |
| $\frac{\Delta V_F}{\Delta T_A}$ | Temperature Coefficient of Forward Voltage | | | -1.80 | | mV/°C | $I_F$ = 16.0mA |
| $BV_R$ | Input Reverse Breakdown Voltage | | 5.0 | | | V | $I_R$ = 10.0µA, $T_A$ = 25°C |
| $C_{IN}$ | Input Capacitance | | | 42 | | pF | f = 1.00MHz, $V_F$ = 0 |
| $I_{IO}$ | Input-Output Insulation Leakage Current | | | | 1.00 | µA | 45% Relative Humidity, t = 5.0 sec, $V_{IO}$ = 1000Vdc, $T_A$ = 25°C (Note 9) |
| $R_{IO}$ | Input-Output Resistance | | | $10^{12}$ | | Ω | $V_{IO}$ = 500 Vdc (Note 9) |
| $C_{IO}$ | Input-Output Capacitance | | | 0.50 | | pF | f = 1.00MHz (Note 9) |
| $h_{FE}$ | Transistor DC Current Gain | | | 150 | | — | $V_O$ = 5.0V, $I_O$ = 3.0mA |

**Switching Specifications** ($T_A$ = 25°C) $V_{CC}$ = 5.0V, $I_F$ = 16.0mA unless otherwise noted

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $t_{PHL}$ | Propagation Delay Time | HDC135 | | 0.50 | 1.50 | µs | $R_L$ = 4.1kΩ (Note 8) |
| | to Logic Low at Output | HDC136 | | 0.20 | 0.80 | µs | $R_L$ = 1.90kΩ (Note 7) |
| $t_{PLH}$ | Propagation Delay Time | HDC135 | | 0.40 | 1.50 | µs | $R_L$ = 4.1kΩ (Note 8) |
| | to Logic High at Output | HDC156 | | 0.30 | 0.80 | µs | $R_L$ = 1.90kΩ (Note 7) |
| $CM_H$ | Common Mode Transient Immunity at Logic High Level Output | HDC135 | | 1000 | | V/µs | $I_F$ = 0mA, $V_{CM}$ = 10.0Vp-p, $R_L$ = 4.1kΩ (Notes 6,8) |
| | | HDC136 | | 1000 | | V/µs | $I_F$ = 0mA, $V_{CM}$ = 10.0Vp-p, $R_L$ = 1.90kΩ (Notes 6, 7) |
| $CM_L$ | Common Mode Transient Immunity at Logic Low Level Output | HDC135 | | -1000 | | V/µs | $V_{CM}$ =10.0Vp-p, $R_L$ =4.1kΩ, (Notes 5, 8) |
| | | HDC136 | | -1000 | | V/µs | $V_{CM}$ =10.0Vp-p, $R_L$ =1.90kΩ, (Notes 5, 7) |

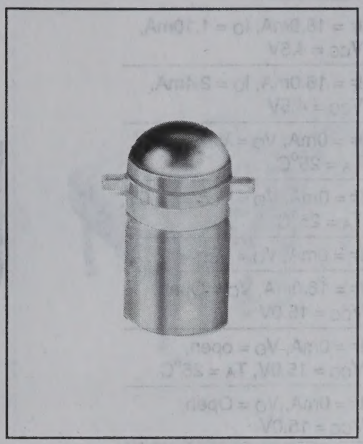
*All typicals at $T_A$ = 25°C and $V_{CC}$ = 5.0V, unless otherwise noted.

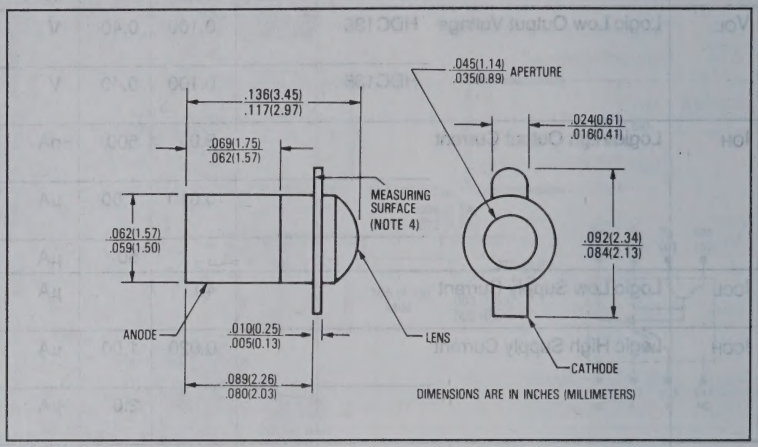


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Hi-Reliability GaAlAs Infrared Emitting Diodes
## Types OP223TX, OP223TXV, OP224TX, OP224TXV






### Features

- Processed to Optek's Military screening program patterned after MIL-S-19500
- Miniature hermetically sealed "pill" package
- Twice the power output of GaAs at the same drive current
- Mechanically and spectrally matched to the OP600 series phototransistor
- S level screening available

### Description

The OP223TX,TXV and OP224TX,TXV are high reliability gallium aluminum arsenide infrared emitting diodes mounted in miniature "pill" type hermetically sealed packages. This package style is intended for direct mounting into PC boards.

After electrical testing by manufacturing, all devices are processed to Optek's 100 percent screening program patterned after MIL-S-19500. After completion of Group A, sample tests are performed for Group B & C inspections.

Gallium aluminum arsenide features twice the radiated output of gallium arsenide at the same forward current. With a wavelength centered at 890 nanometers, it closely matches the spectral response of silicon phototransistors.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Soldering Temperature (for 5 sec. with soldering iron) | 240°C(1) |
| Reverse Voltage | 2.0V |
| Continuous Foward Current | 100mA |
| Power Dissipation | 100mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering.
(2) Derate linearly 1.00mW/°C above 25°C.

# Types OP223TX, OP223TXV, OP224TX, OP224TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | OP223TX,TXV | 1.00 | | | mW | $I_F$ = 50mA |
| | | OP224TX,TXV | 1.50 | | | mW | $I_F$ = 50mA |
| $V_F$ | Forward Voltage | | 0.80 | | 1.80 | V | $I_F$ = 50mA |
| $I_R$ | Reverse Current | | | | 100 | µA | $V_R$ = 2.0V |
| λp | Wavelength at Peak Emission | | | 890 | | nm | $I_F$ = 50mA |
| B | Spectral Bandwidth Between Half Power Points | | | 80 | | nm | $I_F$ = 50mA |
| Δλp/ΔT | Spectral Shift with Temperature | | | 0.18 | | nm/°C | $I_F$ = Constant |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | | 18 | | Deg. | $I_F$ = 50mA |



**100% Processing**

| Screen | Mil-STD-750 Method | Conditions | OP223TX OP224TX | OP223TXV OP224TXV |
|---|---|---|---|---|
| Pre-Cap Visual | | Optek's pre-cap visual(3) | — | 100% |
| High Temperature Storage | 1032 | $T_A$ = 150°C, t = 24hrs. | 100% | 100% |
| Temperature Cycle | 1051 | Condition C, 20 cycles, 15 min. each extreme | 100% | 100% |
| Constant Acceleration | 2006 | 20K G's, $Y_1$ only | 100% | 100% |
| Hermetic Seal | 1071 | Fine: Condition H, 5 X $10^{-8}$atm cc/sec<br>Gross: Condition E | 100% | 100% |
| Power Burn-In(4) | 1038 | Condition B, $T_A$ = 25°C,<br>$I_F$ = 50mA, t = 168hrs. min | 100% | 100% |

(3) Visual inspection based upon Optek's interpretation of pre-cap inspection as specified in MIL-S-19500/548 as applicable for LED's.

(4) 100% electrically tested to the limits in Subgroup 2 of the Group A table before and after burn-in. $\Delta P_O$ = ± 15%; $\Delta V_F$ = ± 10%; PDA = 10%.

# Types OP223TX, OP223TXV, OP224TX, OP224TXV

### Group A Inspection-Electrical Tests

(Performed on each inspection lot after all devices have been subject to the 100% processing requirements.)

| Symbol | Examination or Test | MIL-STD-750 | | n/c | Limit | | Units |
|---|---|---|---|---|---|---|---|
| | | Method | Conditions | | Min | Max | |
| **Subgroup 1** | | | | | | | |
| | Visual and Mechanical Examination | 2071 | LTPD = 5 | | | | |
| **Subgroup 2** | | | | 116/0 | | | |
| $P_O$ | Radiant Power Output OP223TX,TXV | | $I_F$ = 50mADC | | 1.00 | | mW |
| | OP224TX,TXV | | $I_F$ = 50mADC | | 1.50 | | mW |
| $V_F$ | Forward Voltage | 4011 | $I_F$ = 50mADC | | 0.80 | 1.80 | V |
| $I_R$ | Reverse Current | 4016 | $V_R$ = 2.0V | | | 100 | µA |
| **Subgroup 3** | | | | 116/0 | | | |
| $V_F$ | Forward Voltage | 4011 | $I_F$ = 50mADC, $T_A$ = -55°C | | 1.00 | 2.00 | V |
| $I_R$ | Reverse Current | 4016 | $V_R$ = 2.0V, $T_A$ = 100°C | | | 1.00 | mA |

### Group B Inspection

(Performed on each inspection lot)

| Examination or Test | MIL-STD-750 | | LTPD |
|---|---|---|---|
| | Method | Conditions | |
| **Subgroup 1** | | | 15 |
| Solderability | 2026 | | |
| **Subgroup 2** | | | 10 |
| Thermal Shock (temperature cycling) | 1051 | Condition C, 15 min at extremes, 20 cycles | |
| Hermetic Seal | 1071 | | |
| Fine Leak | | Condition H, max leak rate = 5 x $10^{-8}$atm cc/sec | |
| Gross Leak | | Condition E | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 3** | | | 5 |
| Steady-State Operation Life | 1027 | $I_F$ = 50mADC, t = 340hrs, $T_A$ = 25°C | |
| End Points | | Group A, Subgroup 2(6) | |
| **Subgroup 4** | | | |
| Internal Visual Inspection | 2075 | Per pre-seal criteria | 1 Device (0 Failure) |
| Bond Strength | 2037 | Performed at pre-seal | 20 (c=1) |
| **Subgroup 6** | | | 7 |
| High Temperature Life (non-operating) | 1032 | t = 340hrs., $T_A$ = 150°C | |
| End Points | | Group A, Subgroup 2(5) | |

(5) Devices electrically tested before and after life tests to the following limits: 340hrs test, $\Delta P_O = \pm 10\%$; 1000hrs test; $\Delta P_O = \pm 15\%$.

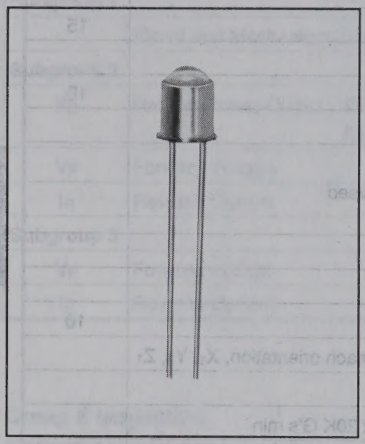
# Types OP223TX, OP223TXV, OP224TX, OP224TXV

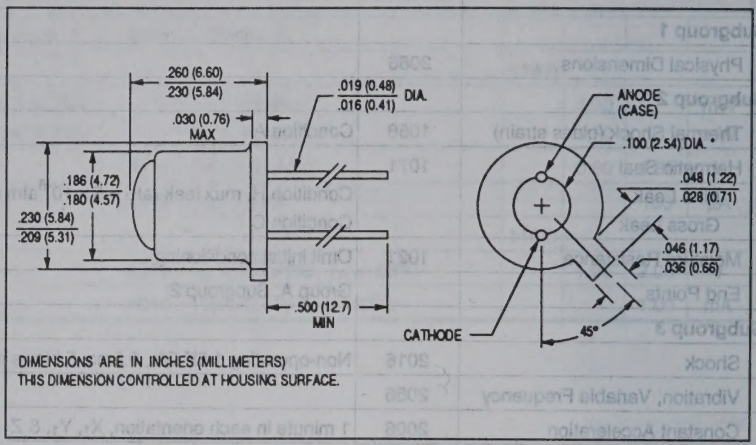
**Group C Inspection**

(Performed every six months while in production)

| Examination or Test | MIL-STD-750 | | LTPD |
|---|---|---|---|
| | Method | Conditions | |
| **Subgroup 1** | | | 15 |
| Physical Dimensions | 2066 | | |
| **Subgroup 2** | | | 10 |
| Thermal Shock (glass strain) | 1056 | Condition A | |
| Hermetic Seal | 1071 | | |
| Fine Leak | | Condition H, max leak rate = $5 \times 10^{-8}$atm cc/sec | |
| Gross Leak | | Condition C | |
| Moisture Resistance | 1021 | Omit initial conditioning | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 3** | | | 10 |
| Shock | 2016 | Non-operating 1.5K G's, 0.5ms, 5 blows in each orientation, $X_1$, $Y_1$, $Z_1$ | |
| Vibration, Variable Frequency | 2056 | | |
| Constant Acceleration | 2006 | 1 minute in each orientation, $X_1$, $Y_1$, & $Z_1$ at 20K G's min | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 4** | | | 15 |
| Salt Atmosphere (corrosion) | 1041 | | |
| **Subgroup 5** | | | |
| Barometric Pressure | 1001 | Not performed | |
| **Subgroup 6** | | | 10 |
| Steady-State Operational Life | 1026 | $I_F$ = 50mA, t = 1000hrs, $T_A = 25^oC$ | |
| End Points | | Group A, Subgroup 2 | |

# Hi-Reliability GaAlAs Infrared Emitting Diodes
## Types OP235TX, OP235TXV, OP236TX, OP236TXV






### Features

- Twice the power output of GaAs at the same drive current
- Characterized to define infrared energy along the mechanical axis of the device
- Mechanically and spectrally matched to the OP804TX/TXV and OP805TX/TXV phototransistors
- Screened per MIL-S-19500 TX or TXV equivalent levels

### Description

The OP235TX, TXV and OP236TX, TXV are high reliability gallium aluminum arsenide infrared emitting diodes mounted in hermetic TO-46 packages. The wavelength is centered at 890 nanometers to closely match the spectral response of silicon photoransistors. Devices are processed to Optek's 100% screening and quality conformance program patterned after MIL-S-19500. After 100% screening, Group A and B are performed on every lot, and a Group C test is performed every six months.

The OP235TX, TXV and OP236TX, TXV have lens cans providing a narrow beam angle (18° between half power points). The narrow beam angle and the specified radiant intensity allow ease of design in beam interrupt applications with the OP804TX, TXV and OP805TX, TXV series of high reliability phototransistors.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Forward DC Current | 100mA |
| Reverse Voltage | 2.0V |
| Operating Temperature | -55°C to +125°C |
| Storage Temperature | -65°C to +150°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |
| Power Dissipation | 200mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering.
(2) Derate linearly 2.00mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average radiant intensity within the cone formed by the measurement surface. The cone is outlined by a radius of 1.429 inches (36.30 mm) measured from the lens side of the tab to the sensing surface and a sensing surface of .250 inches (6.35mm) in diameter forming a 10° cone. $E_{e(APT)}$ is not necessarily uniform within the measured area.

**Recommended replacements for**
**OP231TX, OP231TXV,**
**OP232TX, OP232TXV**

# Types OP235TX, OP235TXV, OP236TX, OP236TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions (3) |
|---|---|---|---|---|---|---|
| $E_{e(APT)}$ | Apertured Radiant Incidence(3,4) | | | | | |
| | OP235TX,TXV | 1.5 | | | mW/cm² | $I_F$ = 100mA |
| | OP236TX,TXV | 3.5 | | | mW/cm² | $I_F$ = 100mA |
| $V_F$ | Forward Voltage(6) | 1.1 | | 2.0 | V | $I_F$ = 100mA |
| | | 1.3 | | 2.2 | V | $I_F$ = 100mA, $T_A$ = -55°C |
| | | 0.9 | | 1.8 | V | $I_F$ = 100mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 2.0V |
| $\lambda p$ | Wavelength at Peak Emission | | 890 | | nm | $I_F$ = 100mA |
| B | Spectral Bandwidth Between Half Power Points | | 50 | | nm | $I_F$ = 100mA |
| $\theta_{HP}$ | Emission Angle at Half Power Points | | 18.0 | | Deg. | $I_F$ = 100mA |

HI REL OPTO COMPONENTS

**100% Processing**

| Screen | Mil-STD-750 Method | Conditions | OP235TX OP236TX | OP235TXV OP236TXV |
|---|---|---|---|---|
| Pre-Cap Visual Inspection | | Optek's pre-cap visual inspection(7) | — | 100% |
| High Temperature Storage | 1032 | $T_A$ = 150°C, t = 24hrs. | 100% | 100% |
| Temperature Cycle | 1051 | Condition C, 20 cycles, -65°C to +150°C, 15 minutes min. each extreme | 100% | 100% |
| Constant Acceleration | 2006 | 20K G's, $Y_1$ only | 100% | 100% |
| Hermetic Seal | 1071 | Fine: Condition H, 5 X $10^{-8}$atm cc/sec<br>Gross: Condition C | 100% | 100% |
| Power Burn-In(6) | 1038 | Condition B, $T_A$ = 25°C, $I_F$ = 100mA, t = 96hrs. min | 100% | 100% |

(4) Measurement is taken during the last 500µs of a single 1.0ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measured results.

(5) Visual inspection based on Optek's interpretation of the requirements of pre-cap inspection as specified in MIL-S-19500/548 as applicable for LED's.

(6) 100% electrically tested to the limits in Subgroup 2 of Group A table before and after Power Burn-in. $\Delta V_F$ = ± 100mV and $\Delta\theta_e$ = ± 15% of pre power Burn-in reading (drift calculations are based on total radiant flux measurements of the device); PDA 10%.

(7) Acceptance of the lot is determined by the drift measurement (D%*e) and not the radiant intensity measurement.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Types OP235TX, OP235TXV, OP236TX, OP236TXV

### Group A Inspection-Electrical Tests

(Performed on each inspection lot after all devices have been subject to the 100% processing requirements.)

| Symbol | Examination or Test | MIL-STD-750 Method | MIL-STD-750 Conditions | LTPD | Limit Min | Limit Max | Units |
|---|---|---|---|---|---|---|---|
| **Subgroup 1** | | | | 5 | | | |
| | Visual and Mechanical Examination | 2071 | | | | | |
| **Subgroup 2** | | | | 2 | | | |
| $E_{e(APT)}$ | Apertured Radiant Incidence OP235TX,TXV | | $I_F$ = 100mA(3) | | 1.5 | | mW/cm$^2$ |
| | OP236TX,TXV | | $I_F$ = 100mA(3) | | 3.5 | | mW/cm$^2$ |
| $V_F$ | Forward Voltage | 4011 | $I_F$ = 100mA | | 1.00 | 2.00 | V |
| $I_R$ | Reverse Current | 4016 | $V_R$ = 5.0Vdc | | | 10 | µA |
| **Subgroup 3** | | | | 2 | | | |
| $V_F$ | Forward Voltage @ $T_A$ = -55°C | 4011 | $I_F$ = 100mA | | 1.30 | 2.20 | V |
| $V_F$ | Forward Voltage @ TA = 100°C | 4011 | $I_F$ = 100mA | | 0.90 | 1.80 | V |

### Group B Inspection

(Performed on each inspection lot)

| Examination or Test | MIL-STD-750 Method | MIL-STD-750 Conditions | LTPD |
|---|---|---|---|
| **Subgroup 1** | | | 15 |
| Solderability | 2026 | | |
| Resistance to Solvents | 1022 | | |
| **Subgroup 2** | | | 10 |
| Thermal Shock (temperature cycling) | 1051 | Condition C, 15 min at extremes, 20 cycles | |
| Hermetic Seal | 1071 | | |
| Fine Leak | | Condition H, max leak rate = 5 x $10^{-8}$atm cc/sec | |
| Gross Leak | | Condition C | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 3** | | | 5 |
| Steady-State Operation Life | 1027 | $I_F$ = 100mA, t = 340hrs, $T_A$ = 25°C | |
| End Points | | Group A, Subgroup 2(7), $\Delta\theta_e$ = ± 10%, $\Delta V_F$ = ± 100mV | |
| Bond Strength | 2037 | All internal wires of each device shall be pulled separately. | 20 (c=1) |
| **Subgroup 4** | | | |
| Internal Visual Inspection | 2075 | Visual criteria in accordance with qualified design. | 1 Device (0 Failure) |
| **Subgroup 6** | | | 7 |
| High Temperature Life (non-operating) | 1032 | t = 340hrs., $T_A$ = 150°C | |
| End Points | | Group A, Subgroup 2(7), $\Delta\theta_e$ = ± 10%, $\Delta V_F$ = ± 100mV | |

# Types OP235TX, OP235TXV, OP236TX, OP236TXV

**Group C Inspection**

(Performed every six months while in production)

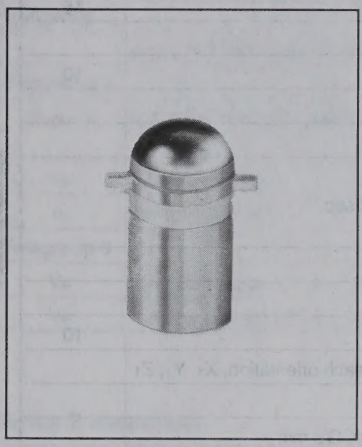
| Examination or Test | MIL-STD-750 | | LTPD |
|---|---|---|---|
| | Method | Conditions | |
| **Subgroup 1** | | | 15 |
| Physical Dimensions | 2066 | | |
| **Subgroup 2** | | | 10 |
| Thermal Shock (glass strain) | 1056 | Condition A | |
| Terminal Strength | 2036 | Condition B | |
| Hermetic Seal | 1071 | | |
| Fine Leak | | Condition H, max leak rate = $5 \times 10^{-8}$atm cc/sec | |
| Gross Leak | | Condition C | |
| Moisture Resistance | 1021 | Omit initial conditioning | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 3** | | | 10 |
| Shock | 2016 | Non-operating 1.5K G's, 0.5ms, 5 blows in each orientation, $X_1$, $Y_1$, $Z_1$ | |
| Vibration, Variable Frequency | 2056 | | |
| Constant Acceleration | 2006 | 1 min in each orientation, $X_1$, $Y_1$, & $Z_1$ at 20K G's min | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 4** | | | 15 |
| Salt Atmosphere (corrosion) | 1041 | | |
| **Subgroup 6** | | | 10 |
| Steady-State Operational Life | 1032 | $I_F$ = 100mA, t = 1000hrs, $T_A = 25^oC$ | |
| End Points | | Group A, Subgroup 2[(6)], $\Delta\theta_e = \pm 15\%$, $\Delta V_F = \pm 100$mV | |

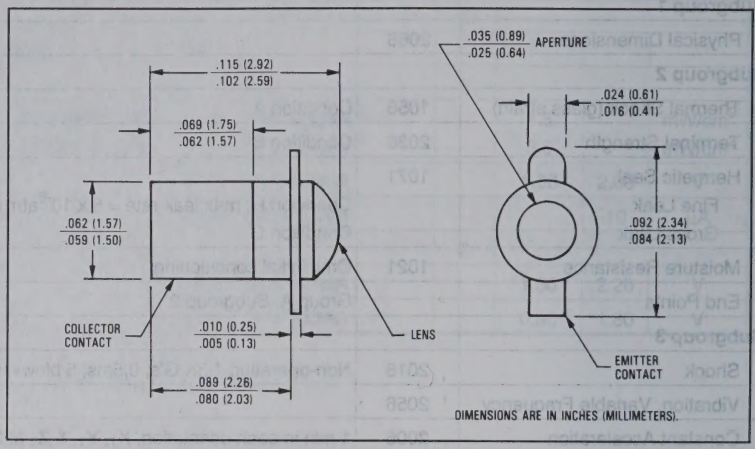


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Hi-Reliability NPN Silicon Phototransistors
## Types OP602TX/V, OP603TX/V, OP604TX/V






### Features

- Processed to Optek's military screening program patterned after MIL-S-19500
- Miniature hermetically sealed package
- Wide range of collector currents
- Ideal for direct mounting in PC boards

### Description

Each device in this series consists of a high reliability NPN silicon phototransistor mounted in a miniature glass lensed, hermetically sealed, "Pill" package.

After electrical testing by manufacturing, all devices are processed to Optek's 100% screening program patterned after MIL-S-19500. After completion of Group A, sample tests are performed for Group B & C inspections.

This device type is lensed and has an acceptance half angle of 18° measured from the optical axis to the half power point. The series is also mechanically and spectrally matched to the OP223 and OP224 high reliability series of infrared emitting diodes.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Collector-Emitter Voltage | 50V |
| Emitter-Collector Voltage | 7.0V |
| Soldering Temperature (for 5 seconds with soldering iron) | 240°C(1) |
| Power Dissipation | 50mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when wave soldering.
(2) Derate linearly 0.5mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is an unfiltered tungsten lamp operating at CT = 2870 K or equivalent source.

# Types OP602TX/V, OP603TX/V, OP604TX/V

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $I_{C(on)}$ | On-State Collector Current | | | | | |
| | OP602TX,TXV | 2.0 | | 5.0 | mA | $V_{CE}$ = 5.0V, $E_e$ = 20mW/cm$^2$[3][4] |
| | OP603TX,TXV | 4.0 | | 8.0 | mA | $V_{CE}$ = 5.0V, $E_e$ = 20mW/cm$^2$[3][4] |
| | OP604TX,TXV | 7.0 | | | mA | $V_{CE}$ = 5.0V, $E_e$ = 20mW/cm$^2$[3][4] |
| $I_{CEO}$ | Collector Dark Current | | | 25 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0 |
| | | | | 100 | µA | $V_{CE}$ = 30.0V, $E_e$ = 0, $T_A$ = 100°C |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 50 | | | V | $I_C$ = 100µA, $E_e$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 7.0 | | | V | $I_E$ = 100µA, $E_e$ = 0 |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 0.40 | V | $I_C$ = 0.4mA, $E_e$ = 20mW/cm$^2$[3][4] |
| $t_r$ | Rise Time | | | 20.0 | µs | $V_{CC}$ = 30V, $I_C$ = 1.00mA, |
| $t_f$ | Fall Time | | | 20.0 | µs | $R_L$ = 100Ω |

HI REL OPTO COMPONENTS

**100% Processing**

| Screen | Mil-STD-750 Method | Conditions | OP602TX OP603TX OP604TX | OP602TXV OP603TXV OP604TX |
|---|---|---|---|---|
| Pre-Cap Visual | 2072 | Optek's pre-cap visual | — | 100% |
| High Temperature Storage | 1032 | $T_A$ = 150°C, t = 24hrs. | 100% | 100% |
| Temperature Cycle | 1051 | Condition C, 20 cycles, 15 min. each extreme | 100% | 100% |
| Constant Acceleration | 2006 | 20K G's, $Y_1$ only | 100% | 100% |
| Hermetic Seal | 1071 | Fine: Condition H, 5 X 10$^{-8}$atm cc/sec<br>Gross: Condition E | 100% | 100% |
| High Temperature Reverse Bias[5] | 1039 | Condition A, $T_A$ = 125°C, $V_{CE}$ = 30Vdc, $E_e$ = 0, t = 48hrs min. | 100% | 100% |
| Power Burn-In[6] | 1039 | Condition B, PT = 50mW min., $T_A$ = 25°C, t = 168hrs. min | 100% | 100% |

(5) 100% electrically tested to the limits in Subgroup 2 of the Group A table before and after HTRB.

(6) 100% electrically tested to the limits in Subgroup 2 of the Group A table before and after burn-in. $\Delta IC_{EO}$ = ± 100% of initial reading or ± 15nA, whichever is greater; $\Delta IC_{(on)}$ = ± 20%, PDA = 10%.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

## Group A Inspection-Electrical Tests

(Performed on each inspection lot after all devices have been subject to the 100% processing requirements.)

| Symbol | Examination or Test | MIL-STD-750 | | n/c | Limit | | Units |
|---|---|---|---|---|---|---|---|
| | | Method | Conditions | | Min | Max | |
| **Subgroup 1** | | | | | | | |
| | Visual and Mechanical Examination | 2071 | LTPD = 5 | | | | |
| **Subgroup 2** | | | | 116/0 | | | |
| $I_{CEO}$ | Dark Current | 3041 | $V_{CE}$ = 10.0Vdc | | | 25 | nA |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 3011 | $I_C$ = 100μAdc, $E_e$ = 0 | | 50 | | V |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 3001 | $I_E$ = 100μAdc, $E_e$ = 0 | | 7.0 | | V |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage(4) | | $I_C$ = 0.40mAdc, $E_e$ = 20mW/cm$^2$ | | | 0.40 | V |
| $I_{C(on)}$ | ON-State Collector Current(4) | | $V_{CE}$ = 5.0Vdc, $E_e$ = 20mW/cm$^2$ | | | | |
| | OP602TX,TXV | | | | 2.0 | 5.0 | mA |
| | OP603TX,TXV | | | | 4.0 | 8.0 | mA |
| | OP604TX,TXV | | | | 7.0 | | mA |
| **Subgroup 3** | | | | 116/0 | | | |
| $I_{CEO}$ | Dark Current | 3041 | $V_{CE}$ = 30Vdc, $E_e$ = 0, $T_A$ = 100°C | | | 100 | μA |
| **Subgroup 4** | | | | 116/0 | | | |
| $t_r$, $t_f$ | Rise and Fall Time | | $V_{CC}$ = 30Vdc, $R_L$ = 100Ω, $I_C$ = 1.0mA | | | 20.0 | μs |

## Group B Inspection

(Performed on each inspection lot)

| Examination or Test | MIL-STD-750 | | LTPD |
|---|---|---|---|
| | Method | Conditions | |
| **Subgroup 1** | | | 15 |
| Solderability | 2026 | | |
| **Subgroup 2** | | | 10 |
| Thermal Shock (temperature cycling) | 1051 | Condition C, 15 min at extremes, 20 cycles | |
| Hermetic Seal | 1071 | | |
| Fine Leak | | Condition H, max leak rate = 5 x 10$^{-8}$atm cc/sec | |
| Gross Leak | | Condition E | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 3** | | | 5 |
| Steady-State Operation Life | 1027 | $P_D$ = 50mW, t = 340hrs, $T_A$ = 25°C | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 4** | | | |
| Internal Visual Inspection | 2075 | Per design criteria | 1 Device (0 Failure) |
| **Subgroup 6** | | | 5 |
| High Temperature Life (non-operating) | 1032 | t = 340hrs., $T_A$ = 150°C | |
| End Points | | Group A, Subgroup 2 | |

(6) Devices electrically tested before and after life tests to the following limits: 340hrs test, ΔPO = ± 10%; 1000hrs test; ΔPO = ± 15%.

# Types OP602TX/V, OP603TX/V, OP604TX/V

## Group C Inspection

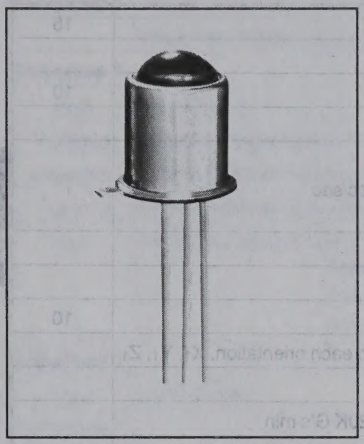
(Performed every six months while in production)

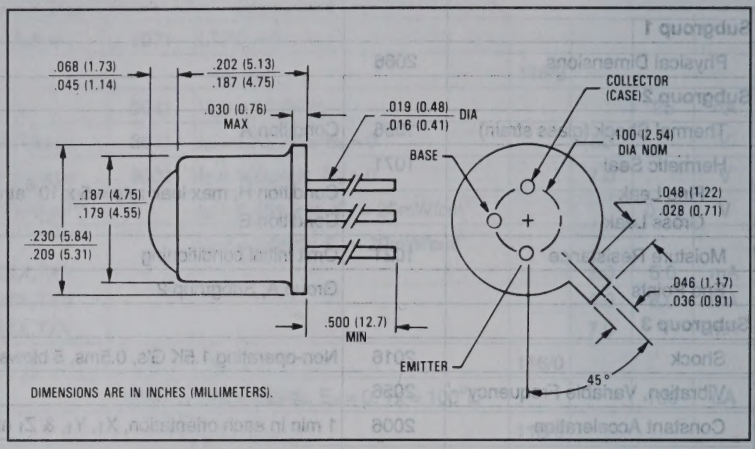
| Examination or Test | MIL-STD-750 | | LTPD |
|---|---|---|---|
| | Method | Conditions | |
| **Subgroup 1** | | | 15 |
| Physical Dimensions | 2066 | | |
| **Subgroup 2** | | | 10 |
| Thermal Shock (glass strain) | 1056 | Condition A | |
| Hermetic Seal | 1071 | | |
| Fine Leak | | Condition H, max leak rate = $5 \times 10^{-8}$atm cc/sec | |
| Gross Leak | | Condition E | |
| Moisture Resistance | 1021 | Omit initial conditioning | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 3** | | | 10 |
| Shock | 2016 | Non-operating 1.5K G's, 0.5ms, 5 blows in each orientation, $X_1$, $Y_1$, $Z_1$ | |
| Vibration, Variable Frequency | 2056 | | |
| Constant Acceleration | 2006 | 1 min in each orientation, $X_1$, $Y_1$, & $Z_1$ at 20K G's min | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 4** | | | 15 |
| Salt Atmosphere (corrosion) | 1041 | | |
| **Subgroup 6** | | | 10 |
| Steady-State Operational Life | 1026 | Power Dissipation = 50mW, t = 1000hrs, $T_A = 25^oC$ | |
| End Points | | Group A, Subgroup 2 | |

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Hi-Reliability NPN Silicon Phototransistor
## Types OP803TX/TXV, OP804TX/TXV, OP805TX/TXV






### Features

- High reliability screening patterned after MIL-S-19500
- Each lot subjected to Group A & B Lot Acceptance
- Lensed for high sensitivity
- Mechanically and spectrally matched to the OP235TX/TXV and OP236TX/TXV series IREDs

### Description

Each device in the OP803, OP804 and OP805TX/TXV series consists of a high reliability NPN phototransistor mounted in a lensed, hermetically sealed, TO-18 package. The TXV devices are subject to a visual inspection per Method 2072 of MIL-STD-750 prior to seal. All devices (both TX and TXV) are 100% screened per Table II of MIL-STD-19500. After completion of the screening, every lot has Group A and B lot acceptance performed. Group C requirements are performed on a lot every six months.

The OP803, OP804 and OP805 TX/TXV series lensing creates an acceptance half angle of 12° measured from the optical axis to the half power point. The series can be matched with either a solid state infrared source, such as the OP235 and OP236 TX/TXV series IREDs, or can be used to sense infrared content in a visible light source, such as a tungsten bulb or sunlight for automatic brightness control.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |
| Collector-Emitter Voltage | 30V |
| Collector-Base Voltage | 30V |
| Emitter-Base Voltage | 5.0V |
| Emitter-Collector Voltage | 5.0V |
| Power Dissipation | 250mW(2) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.5mW/°C above 25°C.

# Types OP803TX/TXV, OP804TX/TXV, OP805TX/TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $I_{C(on)}$ | On-State Collector Current | | | | | |
| | OP803TX,TXV | 4.0 | | 8.0 | mA | $V_{CE}$ = 5.0V, $E_e$ = 5.0mW/cm$^2$(3) |
| | OP804TX,TXV | 7.0 | | 22.0 | mA | $V_{CE}$ = 5.0V, $E_e$ = 5.0mW/cm$^2$(3) |
| | OP805TX,TXV | 15.0 | | | mA | $V_{CE}$ = 5.0V, $E_e$ = 20mW/cm$^2$(3) |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | 100 | nA | $V_{CE}$ = 10.0V, $E_e$ = 0 |
| | | | | 100 | µA | $V_{CE}$ = 10.0V, $E_e$ = 0, $T_A$ = 100°C |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 30 | | | V | $I_C$ = 100µA, $I_E$ = 0, $E_e$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | | V | $I_C$ = 100µA, $I_B$ = 0, $E_e$ = 0 |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | 5.0 | | | V | $I_E$ = 100µA, $I_C$ = 0, $E_e$ = 0 |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 0.40 | V | $I_C$ = 0.4mA, $E_e$ = 5.0mW/cm$^2$(3) |
| $t_r$ | Rise Time OP804TX,TXV | | | 10.0 | µs | $V_{CC}$ = 30V, $I_C$ = 1.00mA, |
| | OP805TX,TXV | | | 15.0 | | $R_L$ = 100Ω |
| $t_f$ | Fall Time OP804TX,TXV | | | 10.0 | µs | |
| | OP805TX,TXV | | | 15.0 | | |

(3) Light source is an unfiltered tungsten lamp operated at a temperature of 2870 K.

HI REL OPTO COMPONENTS

**100% Processing**

| Screen | Mil-STD-750 Method | Conditions | OP803TX OP804TX OP805TX | OP803TXV OP804TXV OP805TXV |
|---|---|---|---|---|
| Pre-Cap Visual | 2072 | Optek's pre-cap visual | — | 100% |
| High Temperature Storage | 1032 | $T_A$ = 150°C, t = 24hrs. | 100% | 100% |
| Temperature Cycle | 1051 | Condition C, 20 cycles, -65°C to +150°C, 15 min. each extreme | 100% | 100% |
| Constant Acceleration | 2006 | 20K G's, $Y_1$ only | 100% | 100% |
| Hermetic Seal | 1071 | Fine: Condition G or H, 5 X 10$^{-8}$atm cc/sec Gross: Condition C | 100% | 100% |
| High Temperature Reverse Bias(4) | 1039 | Condition A, $T_A$ = 125°C, $V_{CB}$ = 24Vdc, $E_e$ = 0, t = 48hrs min. | 100% | 100% |
| Power Burn-In(5) | 1039 | Condition B, PT = 275mW ± 25mW, $T_A$ = 25°C, t = 168hrs. min | 100% | 100% |

(4) 100% electrically tested to the limits in Subgroup 2 of the Group A table before and after HTRB.

(5) 100% electrically tested to the limits in Subgroup 2 of the Group A table before and after burn-in. $\Delta I_{CEO}$ = ± 100% of initial reading or ± 20nA, whichever is greater; $\Delta I_{C(on)}$ = ± 20%, PDA = 10%.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Types OP803TX/TXV, OP804TX/TXV, OP805TX/TXV

### Group A Inspection-Electrical Tests

(Performed on each inspection lot after all devices have been subject to the 100% processing requirements.)

| Symbol | Examination or Test | MIL-STD-750 Method | MIL-STD-750 Conditions | n/c | Limit Min | Limit Max | Units |
|---|---|---|---|---|---|---|---|
| **Subgroup 1** | | | | | | | |
| | Visual and Mechanical Examination | 2071 | LTPD = 5 | | | | |
| **Subgroup 2** | | | | 116/0 | | | |
| $I_{CEO}$ | Collector-Emitter Dark Current | 3041 | $V_{CE}$ = 10.0Vdc, $E_e$ = 0 | | | 100 | nA |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 3001 | $I_C$ = 100µA, $I_E$ = 0, $E_e$ = 0 | | 30 | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 3011 | $I_C$ = 1.00mA, $I_B$ = 0, $E_e$ = 0 | | 30 | | V |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | 3026 | $I_E$ = 100µA, $I_C$ = 0, $E_e$ = 0 | | 5.0 | | V |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | $I_C$ = 0.40mA, $E_e$ = 5.0mW/cm$^2$ | | | 0.40 | V |
| $I_{C(on)}$ | On-State Collector Current | | $V_{CE}$ = 5.0Vdc, $E_e$ = 5.0mW/cm$^2$ | | | | |
| | OP803TX,TXV | | | | 4.0 | 8.0 | mA |
| | OP804TX,TXV | | | | 7.0 | 22.0 | mA |
| | OP805TX,TXV | | | | 15.0 | | mA |
| **Subgroup 3** | | | | 116/0 | | | |
| $I_{CEO}$ | Collector Emitter Dark Current | 3041 | $V_{CE}$ = 10.0Vdc, $E_e$ = 0, $T_A$ = 100°C | | | 100 | µA |
| **Subgroup 4** | | | | 116/0 | | | |
| $t_r$, $t_f$ | Rise and Fall Time OP803TX,TXV | | $V_{CC}$ = 5.0Vdc, $I_C$ = 1.00mAdc | | | 10.0 | µs |
| | OP804TX,TXV | | $R_L$ = 100Ω | | | 10.0 | |
| | OP805TX,TXV | | | | | 15.0 | |

### Group B Inspection

(Performed on each inspection lot)

| Examination or Test | MIL-STD-750 Method | MIL-STD-750 Conditions | LTPD |
|---|---|---|---|
| **Subgroup 1** | | | 15 |
| Solderability | 2026 | | |
| Resistance To Solvents | 1022 | | |
| **Subgroup 2** | | | 10 |
| Thermal Shock (temperature cycling) | 1051 | Condition C, 20 cycles, 15 minutes at extremes | |
| Hermetic Seal | 1071 | | |
| Fine Leak | | Condition G or H, max leak rate = 5 x 10$^{-8}$atm cc/sec | |
| Gross Leak | | Condition C | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 3** | | | 5 |
| Steady-State Operation Life | 1027 | $P_D$ = 250mW, t = 340hrs, $T_A$ = 25°C | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 4** | | | |
| Internal Visual Inspection | 2075 | Per design criteria | 1 device (0 failure) |
| Bond Strength | 2037 | All internal wires of each device shall be pulled separately | 20 |

# Types OP803TX/TXV, OP804TX/TXV, OP805TX/TXV

## Group B Inspection

(Performed on each inspection lot)

| Examination or Test | MIL-STD-750 | | LTPD |
|---|---|---|---|
| | Method | Conditions | |
| **Subgroup 5** | | | 15 |
| Thermal Resistance | 4081 | Not performed | |
| **Subgroup 6** | | | 7 |
| High Temperature Life (non-operating) | 1032 | t = 340hrs., $T_A$ = 150°C | |
| End Points | | Group A, Subgroup 2 | |



## Group C Inspection

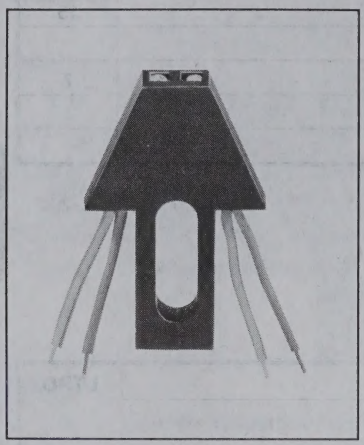
(Performed every six months while in production)

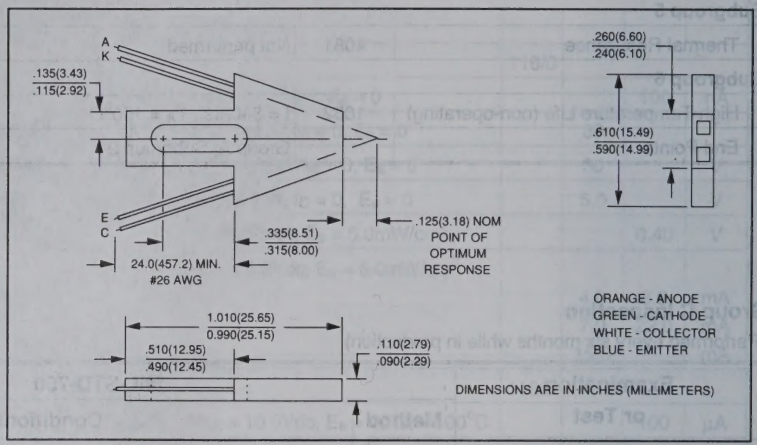
| Examination or Test | MIL-STD-750 | | LTPD |
|---|---|---|---|
| | Method | Conditions | |
| **Subgroup 1** | | | 15 |
| Physical Dimensions | 2066 | | |
| **Subgroup 2** | | | 10 |
| Thermal Shock (glass strain) | 1056 | Condition A | |
| Hermetic Seal | 1071 | | |
| Fine Leak | | Condition G or H, max leak rate = 5 x $10^{-8}$atm cc/sec | |
| Gross Leak | | Condition C | |
| Moisture Resistance | 1021 | Omit initial conditioning | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 3** | | | 10 |
| Shock | 2016 | Non-operating 1.5K G's 0.5ms, 5 blows in each orientation, $X_1$, $Y_1$, $Z_1$ | |
| Vibration, Variable Frequency | 2056 | | |
| Constant Acceleration | 2006 | 1 minute in each orientation, $X_1$, $Y_1$, & $Z_1$ at 20K G's min | |
| End Points | | Group A, Subgroup 2 | |
| **Subgroup 4** | | | 15 |
| Salt Atmosphere (corrosion) | 1041 | | |
| **Subgroup 5** | | | |
| Barometric Pressure | 1001 | Not performed | |
| **Subgroup 6** | | | 10 |
| Steady-State Operational Life | 1026 | $P_D$ = 250mW, t = 1000hrs, $T_A$ = 25°C | |
| End Points | | Group A, Subgroup 2 | |

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Hi-Reliability Reflective Object Sensor
## Types OPB700TX, OPB700TXV






### Features

- Non-contact switching
- Low profile to facilitate stacking
- Hermetically sealed components
- Components processed to Optek's screening program patterned after MIL-S-19500 for TX and TXV devices
- 24.0 inches (457.2mm) minimum length lead wires conforming to MIL-W-16878

### Description

The OPB700TX and OPB700TXV consist of gallium aluminum arsenide LED's and silicon phototransistors mounted side-by side on converging optical axes in a high temperature black plastic housing. The phototransistor responds to the radiation from the LED only when a reflective object passes within its field of view. Lead wires are #26 AWG polytetraflouroethylene (PTEF) insulated conforming to MIL-W-16878.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Operating Temperature | -65°C to +125°C |
| Storage Temperature | -65°C to +150°C |
| **Input Diode** | |
| Forward DC Current | 50mA |
| Reverse Voltage | 2.0V |
| Power Dissipation | 100mW(1) |
| **Output Phototransistor** | |
| Collector-Emitter Voltage | 50V |
| Emitter-Collector Voltage | 7.0V |
| Power Dissipation | 100mW(1) |

**Notes:**
(1) Derate linearly 1.00mW/°C above 25°C.
(2) Measured using an Eastman Kodak neutral white test card having 90% diffuse reflectance as a reflective surface.
(3) Crosstalk ($I_{CX}$) is the collector current measured with the indicated current in the input diode and no reflecting surface.
(4) "d" is the distance from the assembly head to the reflective surface.
(5) Methanol or isopropyl alcohols are recommended as cleaning agents.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPB700TX, OPB700TXV

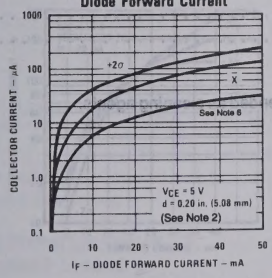
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage(6) | 1.10 | 1.60 | 1.80 | V | $I_F$ = 50.0mA |
| | | 1.30 | 1.80 | 2.00 | V | $I_F$ = 50.0mA, $T_A$ = -55°C |
| | | 0.90 | 1.40 | 1.70 | V | $I_F$ = 50.0mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | 0.1 | 100 | µA | $V_R$ = 2.0V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 50 | 110 | | V | $I_C$ = 1.0mA, $I_F$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 7.0 | 10.0 | | V | $I_E$ = 100µA, $I_F$ = 0 |
| $I_{C(off)}$ | Collector-Emitter Dark Current | | | 100 | nA | $V_{CE}$ = 10.0V, $I_F$ = 0 |
| | | | 10 | 100 | µA | $V_{CE}$ = 10.0V, $I_F$ = 0, $T_A$ = 100°C |
| **Combined** | | | | | | |
| $I_{C(on)}$ | On-State Collector Current d = 0.20 in. (5.08mm)(2,3,6) | 50 | 200 | | µA | $V_{CE}$ = 5.0V, $I_F$ = 40.0mA |
| | | 25 | | | µA | $V_{CE}$ = 5.0V, $I_F$ = 40.0mA, $T_A$ = -55°C |
| | | 25 | | | µA | $V_{CE}$ = 5.0V, $I_F$ = 40.0mA, $T_A$ = 100°C |
| $I_{CX}$ | Crosstalk (No Reflective Surface(3) | | 2.0 | | µA | $V_{CE}$ = 5.0V, $I_F$ = 40.0mA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage d = 0.20 in. (5.08mm)(2,3) | | | 0.40 | V | $I_C$ = 10.0µA, $I_F$ = 40.0mA |
| $t_r$ | Output Rise Time | | 12.0 | 20.0 | µs | $V_{CC}$ = 10.0V, $I_F$ = 20.0mA, $R_L$ = 1,000Ω |
| $t_f$ | Output Fall Time | | 12.0 | 20.0 | µs | |

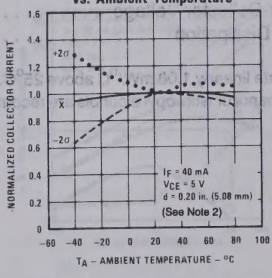
(6) Measurement is taken during the last 500µs of a single 1.0ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measurement results.

**Typical Performance Curves**

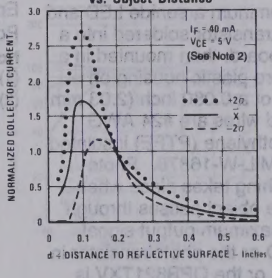
Collector Current vs. Diode Forward Current



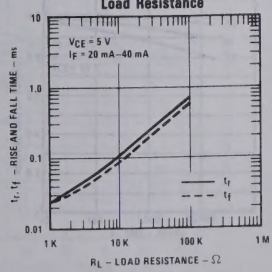

Normalized Collector Current vs. Ambient Temperature



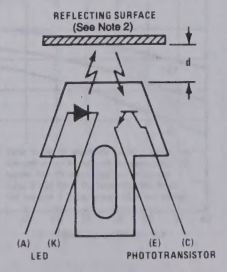

Normalized Collector Current vs. Object Distance




Rise and Fall Time vs. Load Resistance



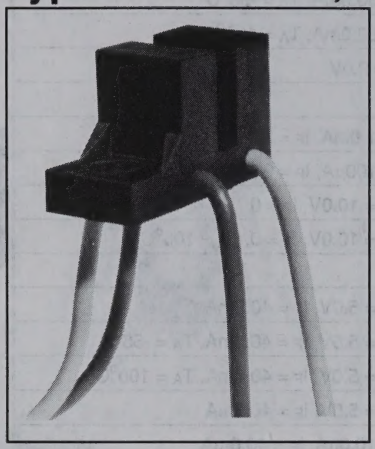

Test Condition

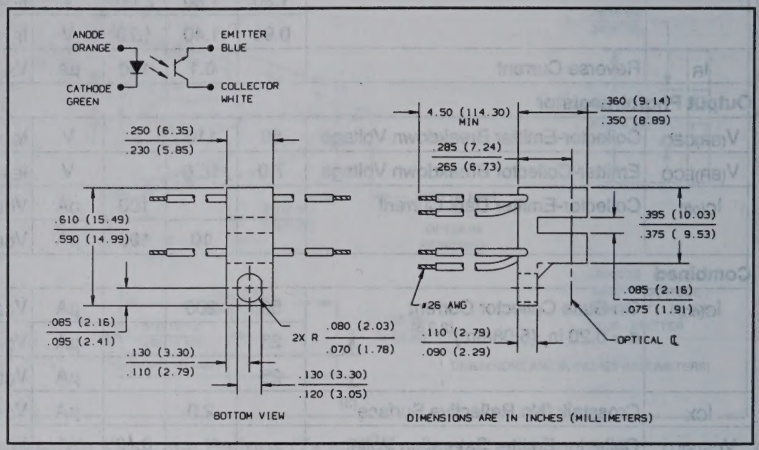



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Hi-Rel Slotted Optical Switches
## Types OPB821TX, OPB821TXV






### Features

- Non-contact switching
- Hermetically sealed components
- Components processed to Optek's screening program patterned after MIL-S-19500 for TX and TXV devices

### Description

The OPB821TX or OPB821TXV consists of a gallium aluminum arsenide LED and a silicon phototransistor soldered into a printed circuit board, then mounted in a high temperature plastic housing on opposite sides of a 0.080 inch (2.03 mm) wide slot. Lead wires are #24 AWG polytetraflouroethylene (PTFE) insulated conforming to MIL-W-16878. Phototransistor switching takes place whenever an opaque object passes through the slot. For maximum output signal, neither the LED or the phototransistor in the OPB821TX or the OPB821TXV is apertured.

The OPB821TX and OPB821TXV use optoelectronic components that have been processed and tested as either TX or TXV components per MIL-S-19500.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Operating Temperature | -65°C to +125°C |
| Storage Temperature | -65°C to +150°C |

### Input Diode

| | |
|---|---|
| Forward DC Current | 50 mA |
| Reverse Voltage | 2.0 V |
| Power Dissipation | 100 mW(1) |

### Output Phototransistor

| | |
|---|---|
| Collector-Emitter Voltage | 50 V |
| Emitter-Collector Voltage | 7.0 V |
| Power Dissipation | 100 mW(1) |

**Notes:**
(1) Derate linearly 1.00 mW/°C above 25°C.
(2) Methanol or isopropyl alcohols are recommended as cleaning agents.

# Types OPB821TX, OPB821TXV

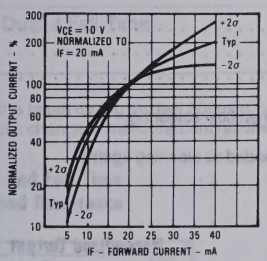
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage(3) | 1.00 | 1.35 | 1.70 | V | $I_F$ = 20.0 mA |
| | | 1.20 | 1.55 | 1.90 | V | $I_F$ = 20.0 mA, $T_A$ = -55°C |
| | | 0.80 | 1.20 | 1.60 | V | $I_F$ = 20.0 mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | 0.1 | 100 | µA | $V_R$ = 2.0 V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 50 | 110 | | V | $I_C$ = 1.0 mA, $I_F$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 7.0 | 10.0 | | V | $I_E$ = 100 µA, $I_F$ = 0 |
| $I_{C(OFF)}$ | Collector-Emitter Dark Current | | 0.2 | 100 | nA | $V_{CE}$ = 10 V, $I_F$ = 0 |
| | | | 10 | 100 | µA | $V_{CE}$ = 10 V, $I_F$ = 0, $T_A$ = 100°C |
| **Coupled** | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current(3) | 800 | | | µA | $V_{CE}$ = 10.0 V, $I_F$ = 20.0 mA |
| | | 500 | | | µA | $V_{CE}$ = 10.0 V, $I_F$ = 20.0 mA, $T_A$ = -55°C |
| | | 500 | | | µA | $V_{CE}$ = 10.0 V, $I_F$ = 20.0 mA, $T_A$ = 100°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.20 | 0.30 | V | $I_C$ = 250 µA, $I_F$ = 20.0 mA |
| $t_r$ | Output Rise Time | | 12.0 | 20.0 | µs | $V_{CC}$ = 10.0 V, $I_F$ = 20.0 mA, |
| $t_f$ | Output Fall Time | | 12.0 | 20.0 | µs | $R_L$ = 1,000 Ω |

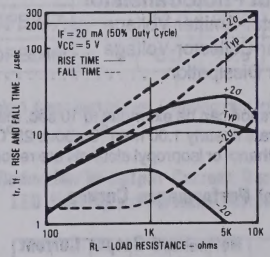
(3) Measurement is taken during the last 500µs of a single 1.0 ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measurement results.

## Typical Performance Curves

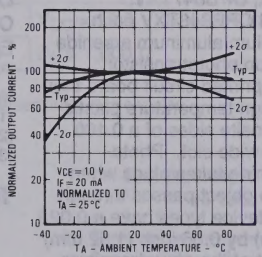
**Normalized Output Current vs Forward Current**



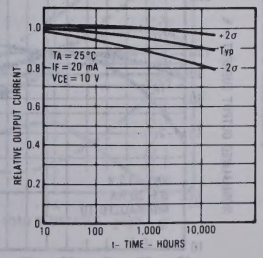

**Rise and Fall Time vs Load Resistance**



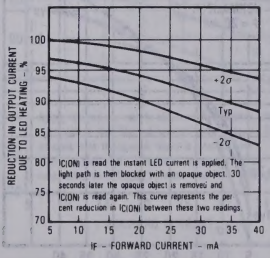

**Normalized Output Current vs Ambient Temperature**




**Relative Output Current vs Time**




**Reduction in Output Current Due to LED Heating vs Forward Current**

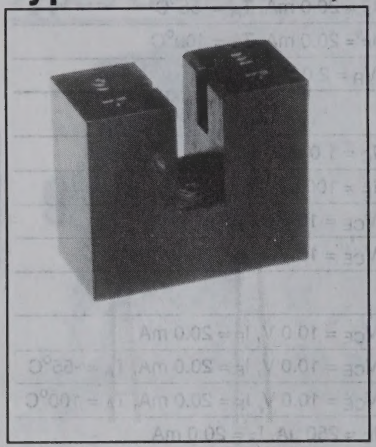

IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the per cent reduction in IC(ON) between these two readings.
REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING - %
IF - FORWARD CURRENT - mA

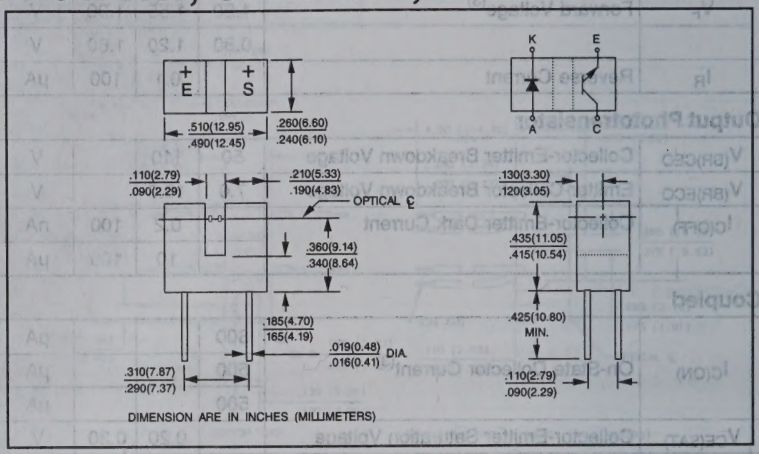
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Hi-Rel Slotted Optical Switches

## Types OPB847TX, OPB847TXV, OPB848TX, OPB848TXV






### Features

- Non-contact switching
- Apertured for high resolution
- Hermetically sealed components
- Components processed to Optek's screening program patterned after MIL-S-19500 for TX and TXV devices

### Description

The OPB847TX, OPB847TXV, OPB848TX and OPB848TXV each consist of a gallium aluminum arsenide LED and a silicon phototransistor soldered into a printed circuit board then mounted in a high temperature plastic housing on opposite sides of a 0.100 inch (2.54 mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot. Both device types have a 0.025 inch (0.635 mm) by 0.06 inch (1.52 mm) aperture in front of the phototransistor for high resolution positioning sensing.

The OPB847TX, OPB847TXV, OPB848TX and OPB848TXV use optoelectronic components that have been processed and tested as either TX or TXV components per MIL-S-19500.

### Absolute Maximum Ratings ($T_A = 25°C$ unless otherwise noted)

| | |
|---|---|
| Operating Temperature | -65°C to +125°C |
| Storage Temperature | -65°C to +150°C |
| Lead Soldering Temperature [1/16 inch (1.6 mm) from case 5 sec. with soldering iron] | 240°C(1) |

### Input Diode

| | |
|---|---|
| Forward DC Current | 50 mA |
| Reverse Voltage | 2.0 V |
| Power Dissipation | 100 mW(2) |

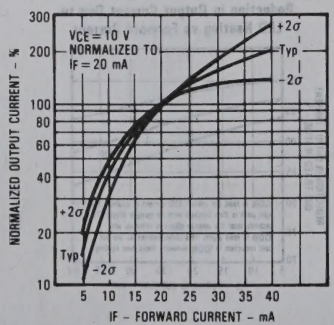
### Output Phototransistor

| | |
|---|---|
| Collector-Emitter Voltage | 50 V |
| Emitter-Collector Voltage | 7.0 V |
| Power Dissipation | 100 mW(2) |

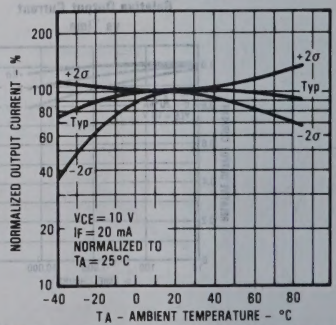
**Notes:**
(1) Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.00 mW/°C above 25°C.
(3) Methanol or isopropyl alcohols are recommended as cleaning agents.

### Typical Performance Curves

**Normalized Output Current vs Forward Current**




**Normalized Output Current vs Ambient Temperature**



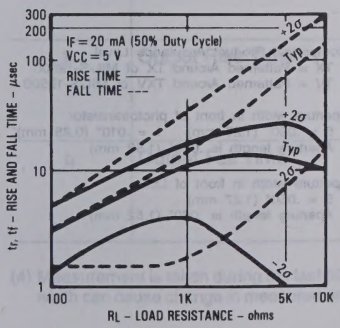
# Types OPB847TX, OPB847TXV, OPB848TX, OPB848TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

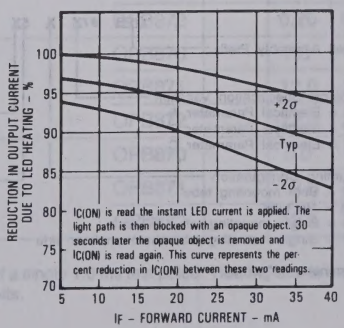
| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage(4) | | 1.00 | 1.35 | 1.70 | V | $I_F$ = 20.0 mA |
| | | | 1.20 | 1.55 | 1.90 | V | $I_F$ = 20.0 mA, $T_A$ = -55°C |
| | | | 0.80 | 1.20 | 1.60 | V | $I_F$ = 20.0 mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | | 0.1 | 100 | µA | $V_R$ = 2.0 V |
| **Output Phototransistor** | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 50 | 110 | | V | $I_C$ = 1.0 mA, $I_F$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 7.0 | 10.0 | | V | $I_E$ = 100 µA, $I_F$ = 0 |
| $I_{C(OFF)}$ | Collector-Emitter Dark Current | | | 0.2 | 100 | nA | $V_{CE}$ = 10 V, $I_F$ = 0 |
| | | | | 10 | 100 | µA | $V_{CE}$ = 10 V, $I_F$ = 0, $T_A$ = 100°C |
| **Coupled** | | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current(4) | OPB847 | 4.0 | | | mA | $V_{CE}$ = 10.0 V, $I_F$ = 20.0 mA |
| | | OPB847 | 2.5 | | | mA | $V_{CE}$ = 10.0 V, $I_F$ = 20.0 mA, $T_A$ = -55°C |
| | | OPB847 | 2.5 | | | mA | $V_{CE}$ = 10.0 V, $I_F$ = 20.0 mA, $T_A$ = 100°C |
| | | OPB848 | 1.0 | | | mA | $V_{CE}$ = 10.0 V, $I_F$ = 20.0 mA |
| | | OPB848 | 0.6 | | | mA | $V_{CE}$ = 10.0 V, $I_F$ = 20.0 mA, $T_A$ = -55°C |
| | | OPB848 | 0.6 | | | mA | $V_{CE}$ = 10.0 V, $I_F$ = 20.0 mA, $T_A$ = 100°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | OPB847 | | 0.20 | 0.30 | V | $I_C$ = 2.0 mA, $I_F$ = 20.0 mA |
| | | OPB848 | | 0.20 | 0.30 | V | $I_C$ = 500 µA, $I_F$ = 20.0 mA |
| $t_r$ | Output Rise Time | OPB847 | | 12.0 | 20.0 | µs | $V_{CC}$ = 10.0 V, $I_F$ = 20.0 mA, |
| | | OPB848 | | 8.0 | 15.0 | µs | $R_L$ = 1,000 Ω |
| $t_f$ | Output Fall Time | OPB847 | | 12.0 | 20.0 | µs | $V_{CC}$ = 10.0 V, $I_F$ = 20.0 mA, |
| | | OPB848 | | 8.0 | 15.0 | µs | $R_L$ = 1,000 Ω |

(4) Measurement is taken during the last 500µs of a single 1.0 ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measurement results.

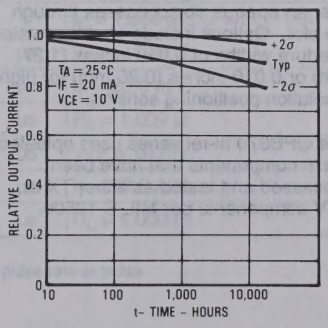
**Rise and Fall Time vs Load Resistance**




**Reduction in Output Current Due to LED Heating vs Forward Current**


REDUCTION IN OUTPUT CURRENT DUE TO LED HEATING – %
IC(ON) is read the instant LED current is applied. The light path is then blocked with an opaque object. 30 seconds later the opaque object is removed and IC(ON) is read again. This curve represents the percent reduction in IC(ON) between these two readings.
+2σ
Typ
-2σ
IF – FORWARD CURRENT – mA

**Relative Output Current vs Time**

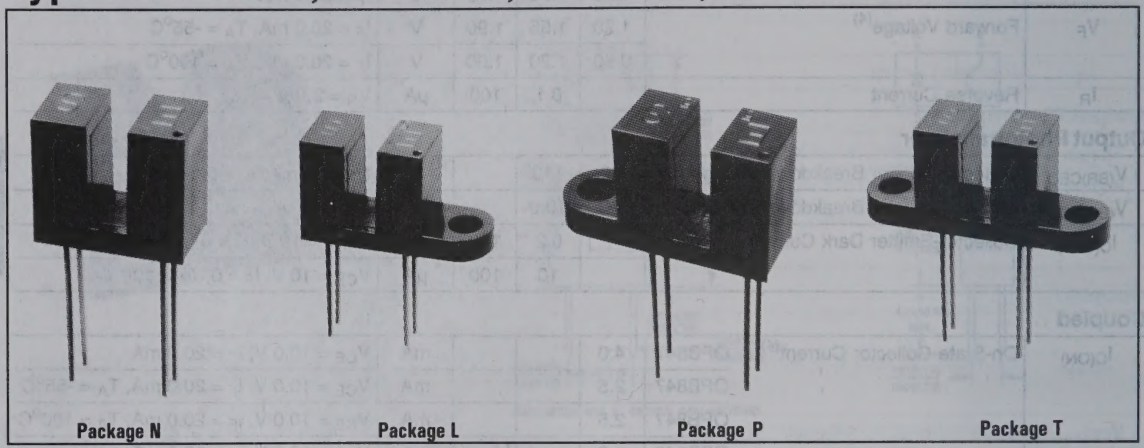



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Hi-Rel Slotted Optical Switches

## Types OPB870N, OPB870L, OPB870P, OPB870T Series



Package N | Package L | Package P | Package T

### Features

- Non-contact switching
- Choice of apertures
- Choice of minimum $I_{C(ON)}$
- Hermetically sealed components
- Components processed to Optek's screening program patterned after MIL-S-19500 for TX and TXV devices
- S level processing available
- Plastic meets NASA publication 1124

### Description

The OPB870 series slotted optical switch consists of a gallium aluminum arsenide LED and a silicon phototransistor soldered into a printed circuit board then mounted in a high temperature plastic housing on opposite sides of a 0.125 inch (3.18 mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot. Options include phototransistor aperture widths of 0.050 inches (1.27 mm) or 0.010 inches (0.25 mm) for high resolution positioning sensing.

The OPB870 hi-rel series uses optoelectronic components that have been processed and tested as either TX or TXV components per MIL-S-19500.

### Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

| | |
|---|---|
| Operating Temperature | -65°C to +125°C |
| Storage Temperature | -65°C to +150°C |
| Lead Soldering Temperature [1/16 inch (1.6 mm) from case 5 sec. with soldering iron] | 240°C(1) |

**Input Diode**

| | |
|---|---|
| Forward DC Current | 50 mA |
| Reverse Voltage | 2.0 V |
| Power Dissipation | 100 mW(2) |

**Output Phototransistor**

| | |
|---|---|
| Collector-Emitter Voltage | 50 V |
| Emitter-Collector Voltage | 7.0 V |
| Power Dissipation | 100 mW(2) |

**Notes:**
(1) Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.00 mW/°C above 25°C.
(3) Methanol or isopropyl alcohols are recommended as cleaning agents.

### Part Numbering Guide

OPB 87X X 5X XX

- OPB: Optek Assembly Prefix
- 87X: Electrical Specification Variation
  - 0 = Electrical Parameter A
  - 1 = Electrical Parameter B
  - 2 = Electrical Parameter C
- X: Mounting Configuration
  - T = Both mounting tabs
  - N = No tabs
  - L = Single mounting tab, LED side
  - P = Single mounting tab, phototransistor side
- 5X: Aperture width in front of LED
  - 5 = .050" (1.27 mm)
  - Aperture length is .060" (1.52 mm)
- XX: Component Product Assurance Level
  - TX = Patterned Around TX of MIL-S-19500
  - TV = Patterned Around TXV of MIL-S-19500
- Aperture width in front of phototransistor
  - 5 = .050" (1.27 mm)  1 = .010" (0.25 mm)*
  - Aperture length is .060" (1.52 mm)

*Parameter "A" only

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Type OPB870 Series

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage[4] | | 1.00 | 1.35 | 1.70 | V | $I_F$ = 20.0 mA |
| | | | 1.20 | 1.55 | 1.90 | V | $I_F$ = 20.0 mA, $T_A$ = -55°C |
| | | | 0.80 | 1.20 | 1.60 | V | $I_F$ = 20.0 mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | | 0.1 | 10 | µA | $V_R$ = 2.0 V |
| **Output Phototransistor** | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 50 | 110 | | V | $I_C$ = 1.0 mA, $I_F$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 7.0 | 10.0 | | V | $I_E$ = 100 µA, $I_F$ = 0 |
| $I_{C(OFF)}$ | Collector-Emitter Dark Current | | | 0.2 | 100 | nA | $V_{CE}$ = 10 V, $I_F$ = 0 |
| | | | | 10 | 100 | µA | $V_{CE}$ = 10 V, $I_F$ = 0, $T_A$ = 100°C |
| **Coupled** | | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current[4] | | | | | | |
| | Parameter A | OPB870 | 500 | | | µA | $V_{CE}$ = 10.0 V, $I_F$ = 20.0 mA |
| | | OPB870 | 200 | | | µA | $V_{CE}$ = 10.0 V, $I_F$ = 20.0 mA, $T_A$ = -55°C |
| | | OPB870 | 200 | | | µA | $V_{CE}$ = 10.0 V, $I_F$ = 20.0 mA, $T_A$ = 100°C |
| | Parameter B | OPB871 | 1000 | | | µA | $V_{CE}$ = 5.0 V, $I_F$ = 10.0 mA |
| | | OPB871 | 400 | | | µA | $V_{CE}$ = 5.0 V, $I_F$ = 10.0 mA, $T_A$ = -55°C |
| | | OPB871 | 400 | | | µA | $V_{CE}$ = 5.0 V, $I_F$ = 10.0 mA, $T_A$ = 100°C |
| | Parameter C | OPB872 | 1800 | | | µA | $V_{CE}$ = 0.4 V, $I_F$ = 20.0 mA |
| | | OPB872 | 800 | | | µA | $V_{CE}$ = 0.4 V, $I_F$ = 20.0 mA, $T_A$ = -55°C |
| | | OPB872 | 800 | | | µA | $V_{CE}$ = 0.4 V, $I_F$ = 20.0 mA, $T_A$ = 100°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | OPB870 | | 0.20 | 0.30 | V | $I_C$ = 400 µA, $I_F$ = 20.0 mA |
| | | OPB871 | | 0.20 | 0.30 | V | $I_C$ = 800 µA, $I_F$ = 10.0 mA |
| | | OPB872 | | 0.20 | 0.30 | V | $I_C$ = 1,800 µA, $I_F$ = 20.0 mA |
| $t_r$ | Output Rise Time | OPB870 | | 8.0 | 15.0 | µs | $V_{CC}$ = 10.0 V, |
| | | OPB871 | | 12.0 | 20.0 | µs | $I_F$ = 20.0 mA, |
| | | OPB872 | | 12.0 | 20.0 | µs | $R_L$ = 1,000 Ω |
| $t_f$ | Output Fall Time | OPB870 | | 8.0 | 15.0 | µs | $V_{CC}$ = 10.0 V, |
| | | OPB871 | | 12.0 | 20.0 | µs | $I_F$ = 20.0 mA, |
| | | OPB872 | | 12.0 | 20.0 | µs | $R_L$ = 1,000 Ω |

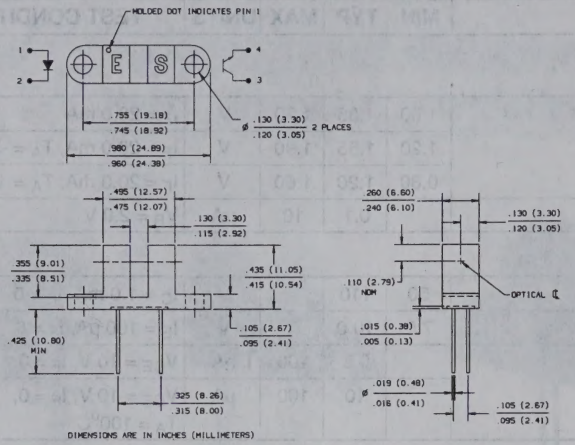
(4) Measurement is taken during the last 500µs of a single 1.0 ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measurement results.



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

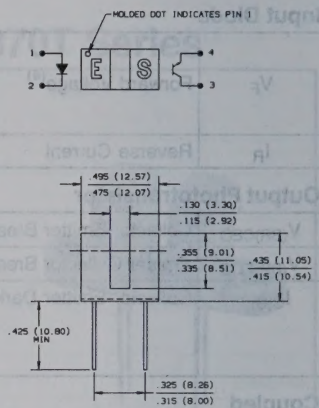
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

## Package Configuration T

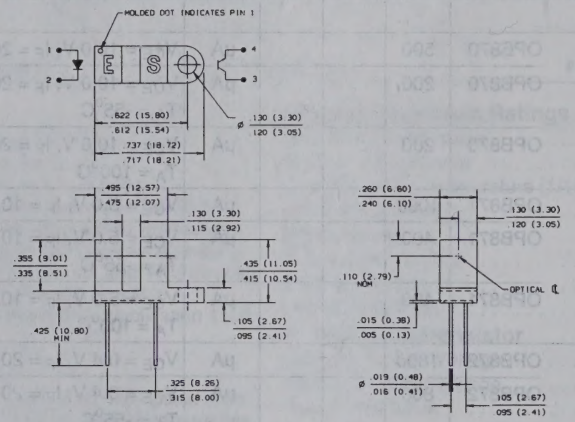



DIMENSIONS ARE IN INCHES (MILLIMETERS)

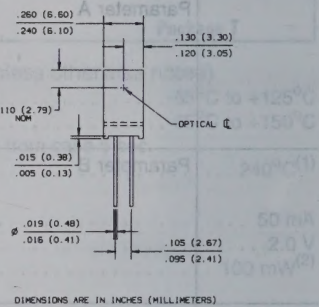
## Package Configuration N




## Package Configuration P

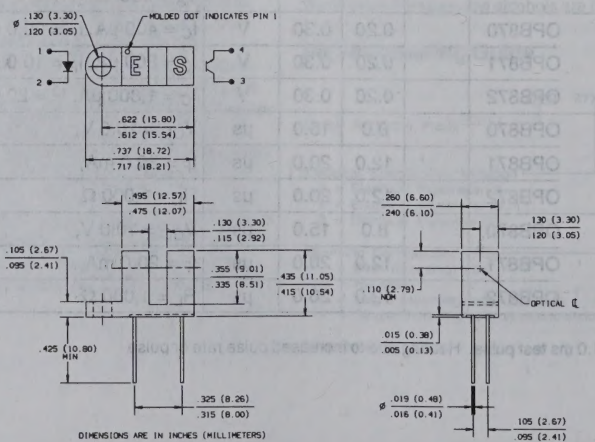



DIMENSIONS ARE IN INCHES (MILLIMETERS)




DIMENSIONS ARE IN INCHES (MILLIMETERS)

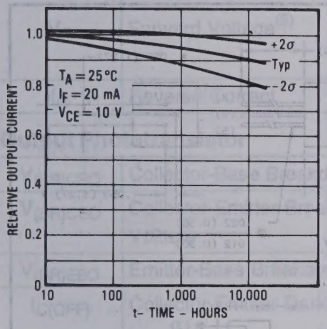
## Package Configuration L



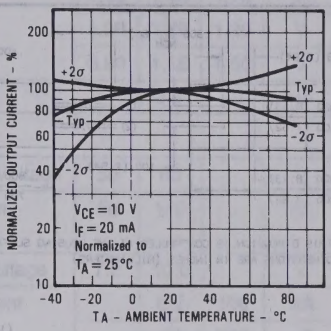

DIMENSIONS ARE IN INCHES (MILLIMETERS)

## Typical Performance Curves

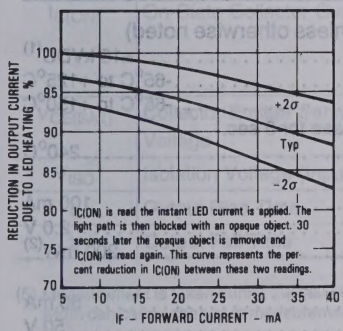
### Relative Output Current vs Time



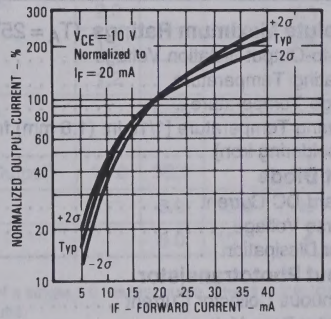

### Normalized Output Current vs Ambient Temperature



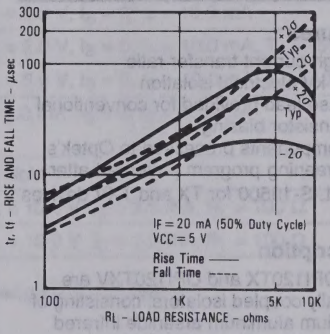

### Reduction in Output Current Due to LED Heating vs Forward Current



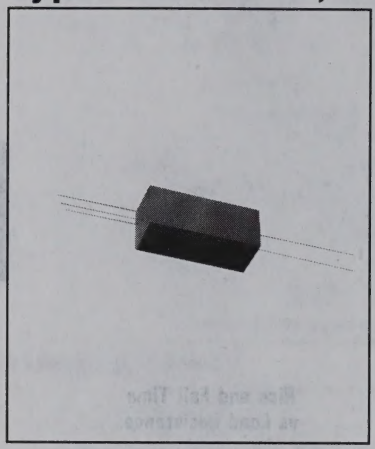

### Normalized Output Current vs Input Current

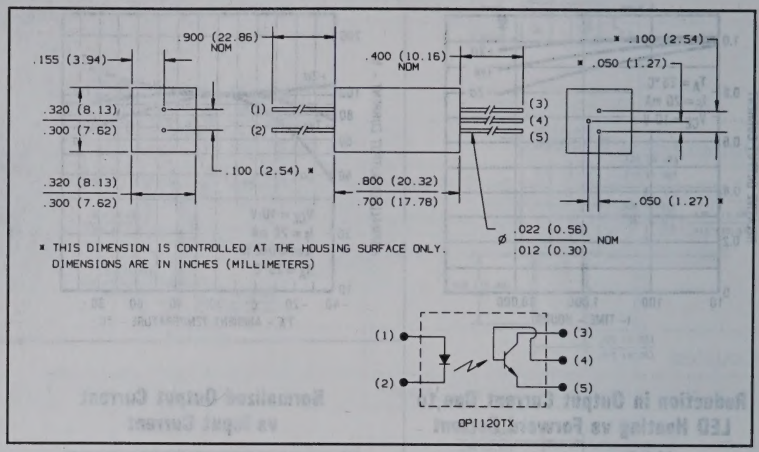



### Rise and Fall Time vs Load Resistance



# Hi-Rel Optically Coupled Isolator
## Types OPI120TX, OPI120TXV






### Features

- High current transfer ratio
- 15 kV electrical isolation
- Base lead provided for conventional transistor biasing
- Components processed to Optek's screening program patterned after MIL-S-19500 for TX and TXV devices

### Description

The OPI120TX and OPI120TXV are optically coupled isolators, consisting of a gallium aluminum arsenide infrared light emitting diode (OP235TX or OP235TXV) and an NPN silicon phototransistor (OP804TX or OP804TXV) sealed in a high dielectric plastic housing. This series is designed for applications requiring high voltage isolation between input and output.

High reliability processing is performed in accordance with MIL-S-19500 for both the infrared light emitting diode and the NPN silicon phototransistor at the component level.

### Absolute Maximum Ratings ($T_A = 25^{\circ}C$ unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ±15 kVDC(1) |
| Operating Temperature | -65°C to +125°C |
| Storage Temperature | -65°C to +150°C |
| Soldering Temperature [1/16 in. (1.6 mm) from case for 5 sec. with soldering iron] | 240°C |

### Input Diode

| | |
|---|---|
| Forward DC Current | 100 mA |
| Reverse Voltage | 2.0 V |
| Power Dissipation | 200 mW(2) |

### Output Phototransistor

| | |
|---|---|
| Continuous Collector Current | 50 mA |
| Collector-Base Voltage | 50 V |
| Collector-Emitter Voltage | 50 V |
| Emitter-Base Voltage | 7.0 V |
| Power Dissipation | 250 mW(3) |

**Notes:**

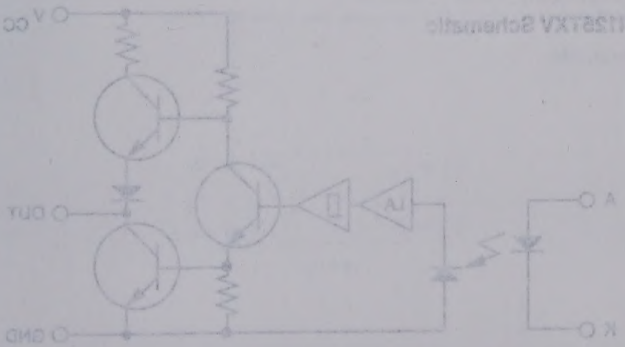
(1) Measured with input leads shorted together and output leads shorted together in air with a maximum relative humidity of 50%. If suitably encapsulated or oil immersed, the isolation voltage is increased to at least 25 kV.
(2) Derate linearly 2.0 mW/°C above 25°C.
(3) Derate linearly 2.5 mW/°C above 25°C.
(4) Methanol or isopropyl alcohols are recommended as cleaning agents.

# Types OPI120TX, OPI120TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage[5] | 1.00 | 1.40 | 1.70 | V | $I_F$ = 30.0 mA |
| | | 1.20 | 1.60 | 1.90 | V | $I_F$ = 30.0 mA, $T_A$ = -55°C |
| | | 0.90 | 1.15 | 1.50 | V | $I_F$ = 30.0 mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | 0.1 | 10 | µA | $V_R$ = 2.0 V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 50 | 80 | | V | $I_C$ = 100 µA, $I_E$ = 0, $I_F$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 50 | 110 | | V | $I_C$ = 1.0 mA, $I_B$ = 0, $I_F$ = 0 |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | 7.0 | 10.0 | | V | $I_E$ = 100 µA, $I_C$ = 0, $I_F$ = 0 |
| $I_{C(OFF)}$ | Collector-Emitter Dark Current | | 0.2 | 100 | nA | $V_{CE}$ = 10 V, $I_B$ = 0, $I_F$ = 0 |
| | | | 10 | 100 | µA | $V_{CE}$ = 10 V, $I_B$ = 0, $I_F$ = 0, $T_A$ = 100°C |
| $I_{CB(OFF)}$ | Collector-Base Dark Current | | 0.1 | 10.0 | nA | $V_{CB}$ = 10 V, $I_E$ = 0, $I_F$ = 0 |
| **Coupled** | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current[5] | 2.0 | | | mA | $V_{CE}$ = 5.0 V, $I_B$ = 0, $I_F$ = 10.0 mA |
| | | 1.2 | | | mA | $V_{CE}$ = 5.0 V, $I_B$ = 0, $I_F$ = 10.0 mA, $T_A$ = -55°C |
| | | 1.2 | | | mA | $V_{CE}$ = 5.0 V, $I_B$ = 0, $I_F$ = 10.0 mA, $T_A$ = 100°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.25 | 0.30 | V | $I_C$ = 2.0 mA, $I_B$ = 0, $I_F$ = 20.0 mA |
| $V_{ISO}$ | Isolation Voltage (Input to Output) | 15.0 | 30.0 | | kV | See Note 1 |
| $t_r$ | Output Rise Time | | 8.0 | 15.0 | µs | $V_{CC}$ = 10.0 V, $I_C$ = 2.0 mA, $R_L$ = 100 Ω |
| $t_f$ | Output Fall Time | | 8.0 | 15.0 | µs | $V_{CC}$ = 10.0 V, $I_C$ = 2.0 mA, $R_L$ = 100 Ω |

(5) Measurement is taken during the last 500µs of a single 1.0 ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measurement results.

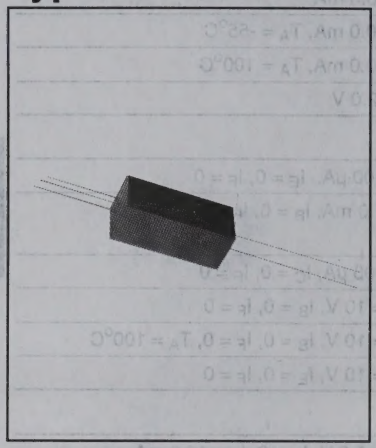


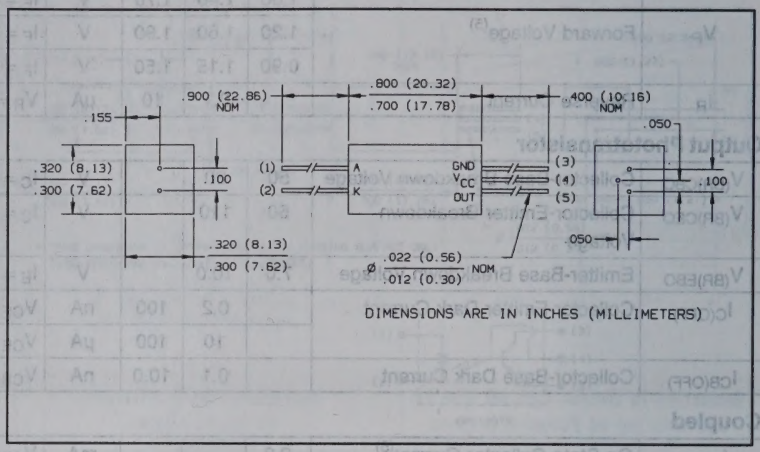


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Hi-Rel Photologic™ Optically Coupled Isolator
## Type OPI125TXV






### Features

- High current transfer ratio
- 15 kV electrical isolation
- Direct TTL/LSTTL interface
- High noise immunity
- Data rates to 250 KBaud
- Components processed to Optek's Hi-Rel screening program

### Description

The OPI125TXV is an optically coupled isolator consisting of a gallium aluminum arsenide infrared light emitting diode (OP235TXV) and a monolithic integrated circuit which incorporates a photodiode, a linear amplifier and a Schmitt trigger on a single die (OPL800TXV) sealed in a high dielectric plastic housing. The device features TTL/LSTTL compatible logic level output which can drive up to 8 TTL loads directly without additional circuitry. Also featured are medium speed data rates to 250 KBaud with typical rise and fall times of 70 nsec. This device is designed for applications requiring high voltage isolation between input and output. High reliability processing is performed in accordance with MIL-S-19500 and MIL-S-883.

### Absolute Maximum Ratings ($T_A = 25^{\circ}C$ unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ±15 kVDC(1) |
| Operating Temperature | -65°C to +125°C |
| Storage Temperature | -65°C to +150°C |
| Soldering Temperature [1/16 in. (1.6 mm) from case for 5 sec. with soldering iron] | 240°C |

### Input Diode

| | |
|---|---|
| Forward DC Current | 100 mA |
| Reverse Voltage | 2.0 V |
| Power Dissipation | 200 mW(2) |

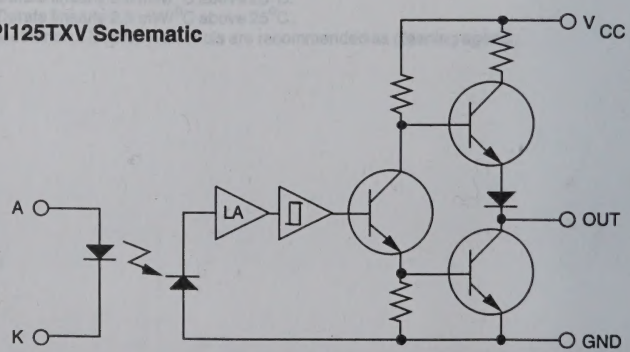
### Output Photologic™

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (not to exceed 3 seconds) | +10.0 V |
| Duration of Output Short to $V_{CC}$ or Ground | 1.00 sec. |
| Power Dissipation | 200 mW(3) |

**Notes:**

(1) Measured with input leads shorted together and output leads shorted together in air with a maximum relative humidity of 50%. If suitably encapsulated or oil immersed, the isolation voltage is increased to at least 25 kV.
(2) Derate linearly 2.00 mW/°C above 25°C.
(3) Derate linearly 2.0 mW/°C above 25°C.

### OPI125TXV Schematic



# Type OPI125TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage(5) | 0.90 | 1.25 | 1.50 | V | $I_F$ = 10.0 mA |
| | | 1.00 | 1.45 | 1.70 | V | $I_F$ = 10.0 mA, $T_A$ = -55°C |
| | | 0.70 | 1.10 | 1.30 | V | $I_F$ = 10.0 mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | 0.1 | 10 | µA | $V_R$ = 2.0 V |
| **Photologic™** | | | | | | |
| $V_{CC}$ | Operating Supply Voltage | 4.8 | | 5.2 | V | |
| $I_{CC}$ | Supply Current | | 7.0 | 15.0 | mA | $V_{CC}$ = 5.2 V, $I_F$ = 0 or 7.5 mA |
| **Coupled** | | | | | | |
| $I_{F(+)}$ | LED Positive-Going Threshold Current(5) | | | 7.5 | mA | $V_{CC}$ = 5.0 V |
| | | | | 7.5 | mA | $V_{CC}$ = 5.0 V, $T_A$ = -55°C |
| | | | | 7.5 | mA | $V_{CC}$ = 5.0 V, $T_A$ = 100°C |
| $I_{F(+)}/I_{F(-)}$ | Hysteresis Ratio | | 2.0 | | | |
| $V_{OL}$ | Low Level Output Voltage | | | 0.40 | V | $V_{CC}$ = 4.8 V, $I_{OL}$ = 13.0 mA, $I_F$ = 0 |
| $V_{OH}$ | High Level Output Voltage | 2.4 | | | V | $V_{CC}$ = 4.8 V, $I_{OH}$ = -800 µA, $I_F$ = 7.5 mA |
| $I_{OS}$ | Short Circuit Output Current | -30.0 | | -120 | mA | $V_{CC}$ = 5.2 V, $I_F$ = 7.5 mA, Output = GND |
| $V_{ISO}$ | Isolation Voltage (Input to Output) | 15.0 | | | kV | See Note 1 |
| $t_r$, $t_f$ | Output Rise Time and Fall Time | | 70.0 | 100 | ns | $V_{CC}$ = 5.0 V, $T_A$ = 25°C, $I_F$ = 0 or 10.0 mA |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay and Low to High & High to Low | | 5.0 | 10.0 | µs | f = 10.0 kHz, D.C. = 50%, $R_L$ = 8 TTL Loads |

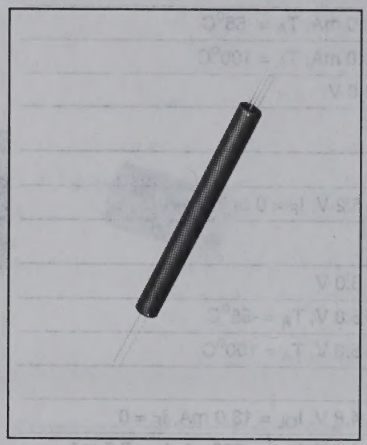
(4) Methanol or isopropyl alcohols are recommended as cleaning agents.
(5) Measurement is taken during the last 500µs of a single 1.0 ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measurement results.

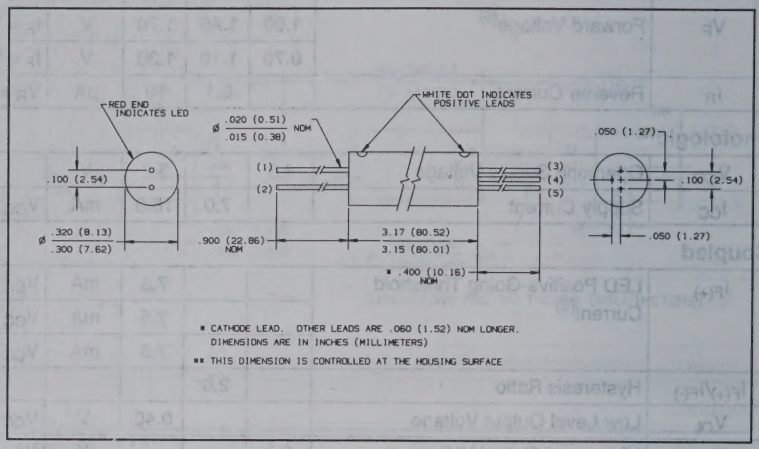


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Optically Coupled Isolators
## Types OPI150TX, OPI150TXV






### Features

- High current transfer ratio
- 50kV electrical isolation
- Base contact lead for conventional transistor biasing
- Components processed to Optek's screening program patterned after MIL-S-19500 for TX and TXV devices.

### Description

The OPI150TX and OPI150TXV are optically coupled isolators, consisting of a gallium aluminum arsenide infrared light emitting diode component (OP235TX or OP235TXV) and optically coupled to an NPN silicon phototransistor component (OP804TX or OP804TXV) by means of a light pipe and sealed in a high dielectric plastic housing. This series is designed for applications requiring very high voltage isolation between input and output.

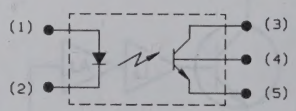
High reliability processing is performed in accordance with MIL-S-19500 for both the infrared light emitting diode and the NPN silicon phototransistor at the component level.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Voltage | ± 50kVDC(1) |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -65°C to +125°C |
| Lead Soldering Temperature[1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C |
| **Input Diode** | |
| Continuous Forward Current | 100mA |
| Reverse Voltage | 2.0V |
| Power Dissipation | 200mW(2) |
| **Output Photosensor** | |
| Continuous Collector Current | 50mA |
| Collector-Emitter Voltage | 50V |
| Emitter-Base Voltage | 7.0V |
| Collector-Base Voltage | 50V |
| Power Dissipation | 250mW(3) |

**Notes:**
(1) Measured with input and output leads shored together in air with maximum relative humidity of 50%.
(2) Derate linearly 2.00mW/°C above 25°C.
(3) Derate linearly 2.50mW/°C above 25°C.
(4) Methanol or isopropanol are recommended as cleaning agents.

### Schematic




OPI150

# Types OPI150TX, OPI150TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage[5] | 1.0<br>1.2<br>0.9 | 1.4<br>1.6<br>1.15 | 1.7<br>1.9<br>1.5 | V<br>V<br>V | $I_F$ = 30 mA<br>$I_F$ = 30 mA, $T_A$ = -55°C<br>$I_F$ = 30 mA, $T_A$ = 100°C |
| $I_R$ | Reverse Current | | 0.1 | 10 | µA | $V_R$ = 2.0 V |
| **Output Photosensor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 50 | 80 | | V | $I_C$ = 1.0 mA, $I_B$ = 0, $I_F$ = 0 |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | 7.0 | 110 | | V | $I_E$ = 100 µA, $I_C$ = 0, $I_F$ = 0 |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 50 | 10.0 | | V | $I_C$ = 100 µA, $I_E$ = 0, $I_F$ = 0 |
| $I_{CEO}$ | Collector-Emitter Dark Current | | 0.2<br>10 | 100<br>100 | nA<br>µA | $V_{CE}$ = 10.0 V, $I_B$ = 0, $I_F$ = 0<br>$V_{CE}$ = 10.0 V, $I_B$ = 0, $I_F$ = 0, $T_A$ = 100°C |
| $I_{CBO}$ | Collector-Base Dark Current | | 0.1 | 10 | nA | $V_{CB}$ = 10.0 V, $I_E$ = 0, $I_F$ = 0 |
| **Coupled** | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current[5] | 1.0<br>0.6<br>0.6 | | | mA<br>mA<br>mA | $V_{CE}$ = 5 V, $I_B$ = 0, $I_F$ = 10 mA<br>$V_{CE}$ = 5 V, $I_B$ = 0, $I_F$ = 10 mA, $T_A$ = -55°C<br>$V_{CE}$ = 5 V, $I_B$ = 0, $I_F$ = 10 mA, $T_A$ = 100°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.20 | 0.30 | V | $I_C$ = 1.0 mA, $I_B$ = 0, $I_F$ = 16.0 mA |
| $V_{ISO}$ | Isolation Voltage (Input-to-Output) | 50.0 | | | kV | See Note 1 |
| $t_r$ | Output Rise Time | | 8.0 | 15.0 | µs | $V_{CC}$ = 10.0 V, $I_C$ = 2.0 mA, $R_L$ = 100 Ω |
| $t_f$ | Output Fall time | | 8.0 | 15.0 | µs | $V_{CC}$ = 10.0 V, $I_C$ = 2.0 mA, $R_L$ = 100 Ω |

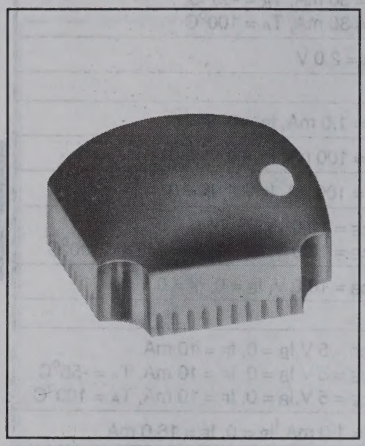
(5) Measurement is taken during last 500µs of a single ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measurement results.

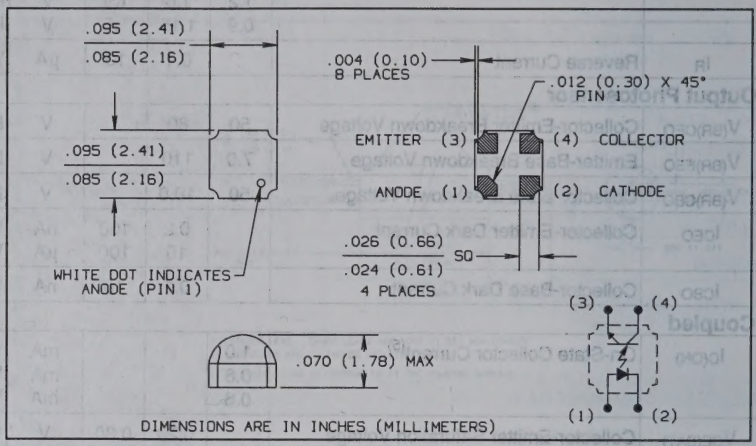


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Surface Mount Optically Coupled Isolators
## Types OPI210, OPI211






### Features

- Micro-miniature package ideal for hybrid applications
- TTL, DTL compatible
- High DC current transfer ratio
- Four bonding pads for attaching to hybrid substrates
- 1kV electrical isolation
- High efficiency gallium aluminum arsenide emitter

### Description

The OPI210 and OPI211 are optically coupled isolators each consisting of a gallium aluminum arsenide LED and a silicon phototransistor mounted and coupled on a thick film ceramic substrate. These solid-state optocouplers are ideal for hybrid applications. Four thick film bonding pads make electrical connections easy.

The OPI210 and OPI211 are identical except for the DC current transfer ratio. Both were designed with high reliability in mind and are ideally suited for use in MIL-STD-883 hybrid applications.

Device mounting may be achieved using silver or gold filled epoxies. The OPI210 and OPI211 are sensitive to some hybrid cleaning processes. Consult factory for details.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ±1000VDC(1) |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| **Input Diode** | |
| Continuous Forward DC Current | 50mA |
| Peak Forward Current (1 µs pulse width, 300 pps) | 1.00A |
| Reverse Voltage | 3.0V |
| Power Dissipation | 60mW(2) |
| **Output Sensor** | |
| Continuous Collector Current | 50mA |
| Collector-Emitter Voltage | 35V |
| Emitter-Collector Voltage | 7.0V |
| Power Dissipation | 100mW(3) |

**Notes:**
(1) Measured with input diode bond pads shorted together and output bond pads shorted together.
(2) Derate linearly above 65°C free air temperature at the rate 1.0mW/°C.
(3) Derate linearly above 25°C free air temperature at the rate of 1.0mW/°C.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Types OPI210, OPI211

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | | |
| $V_F$ | Forward Voltage | | | 1.15 | 1.50 | V | $I_F$ = 10.0mA |
| $I_R$ | Reverse Current | | | 0.1 | 100 | µA | $V_R$ = 2.0V |
| **Output Sensor** | | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | 35 | 80 | | V | $I_C$ = 100µA, $I_F$ = 0 |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | | 7.0 | 10.0 | | V | $I_E$ = 100µA, $I_F$ = 0 |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | 20 | 100 | nA | $V_{CE}$ = 20V, $I_F$ = 0 |
| **Coupled** | | | | | | | |
| $I_C/I_F$ | DC Current Transfer Ratio | OPI210 | 50 | 200 | | % | $V_{CE}$ = 5.0V, $I_F$ = 10.0mA |
| | | OPI211 | 200 | 350 | | % | $V_{CE}$ = 5.0V, $I_F$ = 10.0mA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 0.2 | 0.30 | V | $I_C$ = 2.0mA, $I_F$ = 20mA |
| $t_r$ | Output Rise Time | | | 3.0 | 10.0 | µs | $V_{CC}$ = 10.0V, $R_L$ = 100Ω |
| $t_f$ | Output Fall Time | | | 3.0 | 10.0 | µs | Pulse width = 100ms, duty cycle = 1% |

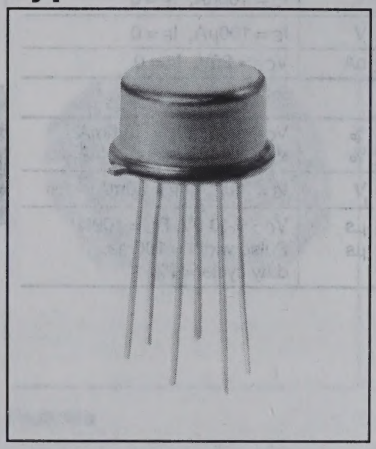
HI REL OPTO COMPONENTS

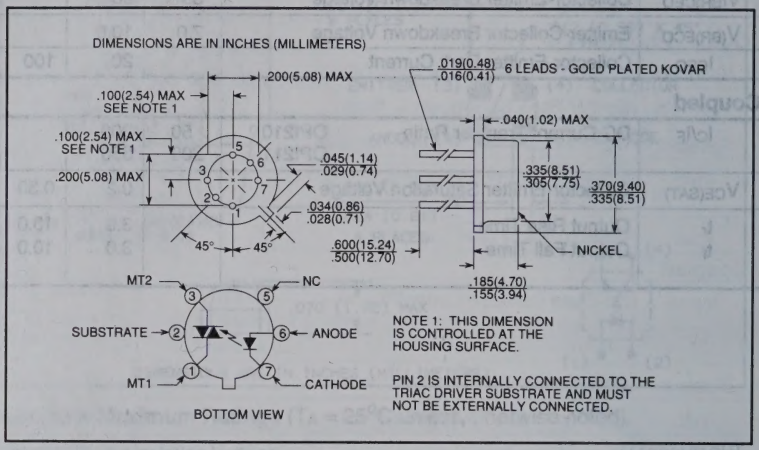
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Zero Voltage Crossing Optically Coupled Triac Driver

## Type OPI340






### Features

- For 220 VAC operation
- 1000 VDC electrical isolation
- Zero voltage crossing for reduced EMI, line noise, and improved static dV/dt
- TO-78 hermetically sealed package
- Optek's Military screened version available on request
- -55°C to +125°C operating range

### Description

The OPI340 consists of a gallium aluminum arsenide infrared emitting diode and a monolithic integrated circuit containing a photodiode and a zero voltage bidirectional triac driver, mounted in a six pin TO-78 hermetic package. The device is intended to be used for low power DC controlling of power triacs which in turn control resistive, inductive, or capacitive loads powered from 220 VAC. Zero voltage crossing ensures that the device will not turn on until the line voltage reduces to 15 volts, typical.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Input-to-Output Isolation Voltage | ±1.0 kVDC(1) |
| Operating Temperature | -55°C to +125°C |
| Storage Temperature | -65°C to +150°C |
| Soldering Temperature (1/16 inch from case for 5 sec. w/soldering iron) | 240°C |

### Input Diode

| | |
|---|---|
| Forward DC Current (65°C or below) | 40 mA |
| Reverse Voltage | 3.0 V |
| Power Dissipation | 60 mW(2) |

### Output Photosensor

| | |
|---|---|
| Off-State Terminal Voltage | 400 V |
| On-State RMS Current (Full Cycle, 50-60 Hz, $T_A$ = 25°C) | 100 mA |
| On-State RMS Current (Full Cycle, 50-60 Hz, $T_A$ = 70°C) | 50 mA |
| Peak Non-Repetitive Surge Current (PW = 10 ms, duty cycle = 10%) | 1.20 A |
| Power Dissipation | 300 mW(3) |

**Notes:**
(1) Measured with inputs shorted together and outputs shorted together.
(2) Derate linearly 1.0 mW/°C above 65°C.
(3) Derate linearly 3.0 mW/°C above 25°C.

# Type OPI340

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

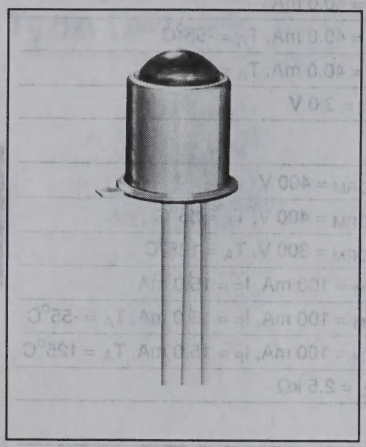
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | 1.20 | | 1.80 | V | $I_F$ = 40.0 mA |
| | | 1.00 | | 2.20 | V | $I_F$ = 40.0 mA, $T_A$ = -55°C |
| | | 0.80 | | 1.50 | V | $I_F$ = 40.0 mA, $T_A$ = 125°C |
| $I_R$ | Reverse Current | | | 100 | µA | $V_R$ = 3.0 V |
| **Output Phototransistor** | | | | | | |
| $I_{DRM}$ | Peak Blocking Current, Either Direction | | 10.0 | 100 | nA | $V_{DRM}$ = 400 V |
| | | | | 6.0 | µA | $V_{DRM}$ = 400 V, $T_A$ = 85°C |
| | | | | 6.0 | µA | $V_{DRM}$ = 300 V, $T_A$ = 125°C |
| $V_{TM}$ | Peak On-State Voltage, Either Direction | | 1.75 | 3.0 | V | $I_{TM}$ = 100 mA, $I_F$ = 15.0 mA |
| | | | | 3.0 | V | $I_{TM}$ = 100 mA, $I_F$ = 15.0 mA, $T_A$ = -55°C |
| | | | | 5.0 | V | $I_{TM}$ = 100 mA, $I_F$ = 15.0 mA, $T_A$ = 125°C |
| dV/dt | Critical Rate of Rise of Off-State Voltage | 100 | | | V/µs | $R_L$ = 2.5 kΩ |
| **Coupled** | | | | | | |
| $I_{FT}$ | LED Trigger Current Required to Latch | | | 15.0 | mA | $V_{TM}$ = 3.0 V, $R_L$ = 150 Ω |
| | | | | 20.0 | mA | $V_{TM}$ = 5.0 V, $R_L$ = 150 Ω, $T_A$ = -55°C |
| | | | | 22.0 | mA | $V_{TM}$ = 5.0 V, $R_L$ = 150 Ω, $T_A$ = 125°C |
| $I_H$ | Holding Current, Either Direction | | 200 | | µA | |
| $V_{ISO}$ | Isolation Voltage | 1000 | | | VDC | See Note (1) |
| $V_{I(TH)}$ | Zero Voltage Crossing Inhibit Voltage Threshold | | | 40 | V | $I_{FT}$ = 15.0 mA |
| | | | | 40 | V | $I_{FT}$ = 15.0 mA, $T_A$ = -55°C |
| | | | | 40 | V | $I_{FT}$ = 15.0 mA, $T_A$ = 125°C |
| $I_{R(I)}$ | Leakage Current in Inhibit State | | | 300 | µA | $I_{FT}$ = 15.0 mA, $V_{MT}$ = 400 V |
| | | | | 600 | µA | $I_{FT}$ = 20.0 mA, $V_{MT}$ = 400 V, $T_A$ = -55°C |
| | | | | 300 | µA | $I_{FT}$ = 22.0 mA, $V_{MT}$ = 300 V, $T_A$ = 125°C |

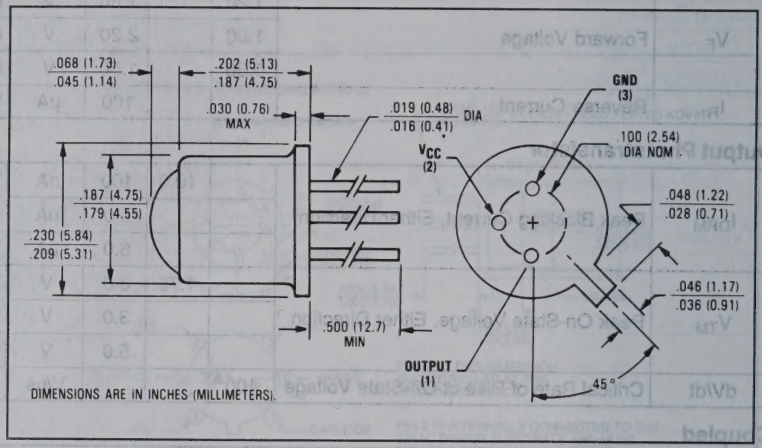


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Hi-Reliability Photologic™ Hermetic Sensors
## Type OPL800TXV






### Features

- 100% screened and quality conformance tested to Optek's Hi-Rel program
- Direct TTL/STTL interface
- Hermetic, lensed TO-18 package
- Mechanically and spectrally matched OP235/OP236TX/TXV LEDs

### Description

The OPL800TXV is a high reliability optoelectronic microcircuit that incorporates a photodiode, linear amplifier, and Schmitt trigger on a single silicon chip. The device features TTL/STTL compatible logic level output which can drive up to 8 TTL loads without additional interface circuitry. The Photologic™ chip is mounted on a standard TO-18 header which is hermetically sealed in a lensed metal can. These devices are mechanically and spectrally matched to the OP235TX/TXV and 236TX/TXV infrared emitting diodes. All parts are processed to Optek's 100 percent screening program patterned after Method 5004 of MIL-STD-883 and the quality conformance testing in Method 5005 for Class B devices. Complete details of the Hi-Rel program are given on the following pages.

Typical characteristic curves are shown on the commercial OPL800 data sheet.

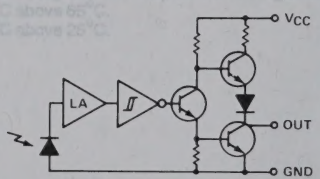
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (not to exceed 3 sec.) | +10.0V |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Lead Soldering Temperature [1/16 (1.6mm) inch from case for 5 sec. with soldering iron] | 240°C(1) |
| Power Dissipation | 250mW(2) |
| Duration of Output Short to $V_{CC}$ or Ground | 1.00 sec. |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when wave soldering.
(2) Derate linearly 2.5mW/°C above 25°C.
(3) Light measurements are made with λ = 935nm.

### Schematics

**OPL800TXV** (Totem-Pole Output Buffer)



# Type OPL800TXV

## 100% Processing

| Screen | Mil-STD-883 Method | Conditions | OPL800TXV |
|---|---|---|---|
| Internal Visual | 2010 | Condition B | 100% |
| High Temperature Storage | 1008 | Condition C, $T_A$ = 150°C, t = 24hrs. | 100% |
| Temperature Cycle | 1010 | Condition C, 10 Cycles, -65°C to 150°C, 15 min. each extreme | 100% |
| Constant Acceleration | 2001 | Condition E, $Y_1$ orientation, 5K G's for 1 min. | 100% |
| Hermetic Seal | 1014 | Fine: Condition A or B, 5 X $10^{-8}$atm cc/sec Gross: Condition C, D, or E | 100% |
| Power Burn-In(4) | 1015 | Condition B, $T_A$ = 25°C, $V_{CC}$ = 5.25V, t = 168hrs. min | 100% |
| Seal | 1014 | Fine leak, Gross leak | 100% |
| External Visual Examination | 2009 | | 100% |

(4) 100% electrically tested to the limits in Subgroups 1 and 9 of the Group A table before and after burn-in.

## Group A Inspection-Electrical Tests

(Performed on each inspection lot after all devices have been subject to the 100% processing requirements.)

| Symbol | Examination or Test | MIL-STD-883 | | n/c | Limit | | Units |
|---|---|---|---|---|---|---|---|
| | | Method | Conditions | | Min | Max | |
| **Subgroup 1(5)** | | | | 2 | | | |
| $I_{CCH}$ | Supply Current, High | 3005 | $V_{CC}$ = 5.25V, $E_e$ = 2.0mW/cm$^2$ | | | 15.0 | mA |
| $I_{CCL}$ | Supply Current, Low | 3005 | $V_{CC}$ = 5.25V, $E_e$ = 0 | | | 15.0 | mA |
| $V_{OL}$ | Low Level Output Voltage | 3007 | $V_{CC}$ = 4.75, $I_{OL}$ = 12.8mA, $E_e$ = 0 | | | 0.40 | V |
| $V_{OH}$ | High Level Output Voltage | 3006 | $V_{CC}$ = 4.75, $I_{OH}$ = -800µA, $E_e$ = 2.0mW/cm$^2$ | | 2.4 | | V |
| $I_{OS}$ | Short Circuit Output Voltage | 3011 | $V_{CC}$ = 4.75, $E_e$ = 2.0mW/cm$^2$, Output = GND | | -30 | -120 | mA |
| Subgroup 2(5) | | | $T_A$ = +125°C | 2 | | | |
| $I_{CCH}$ | Supply Current, High | 3005 | $V_{CC}$ = 5.25V, $E_e$ = 2.0mW/cm$^2$ | | | 15.0 | mA |
| $I_{CCL}$ | Supply Current, Low | 3005 | $V_{CC}$ = 5.25V, $E_e$ = 0 | | | 15.0 | mA |
| $V_{OL}$ | Low Level Output Voltage | 3007 | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA, $E_e$ = 0 | | | 0.40 | V |
| $V_{OH}$ | High Level Output Voltage | 3006 | $V_{CC}$ = 4.75V, $I_{OH}$ = -800µA, $E_e$ = 2.0mW/cm$^2$ | | 2.4 | | V |
| Subgroup 3(5) | | | $T_A$ = -55°C | 2 | | | |
| $I_{CCH}$ | Supply Current, High | 3005 | $V_{CC}$ = 5.25V, $E_e$ = 2.0mW/cm$^2$ | | | 15.0 | mA |
| $I_{CCL}$ | Supply Current, Low | 3005 | $V_{CC}$ = 5.25V, $E_e$ = 0 | | | 15.0 | mA |
| $V_{OL}$ | Low Level Output Voltage | 3007 | $V_{CC}$ = 4.75V, $I_{OL}$ = 12.8mA, $E_e$ = 0 | | | 0.40 | V |
| $V_{OH}$ | High Level Output Voltage | 3006 | $V_{CC}$ = 4.75V, $I_{OH}$ = -800µA, $E_e$ = 2.0mW/cm$^2$ | | 2.4 | | V |
| Subgroup 4(5) | | | | 2 | | | |
| $t_r$, $t_f$ | Rise and Fall Time | 3004 | $V_{CC}$ = 5.0V, $R_L$ = 8TTL loads | | | 70.0 | ns |
| $t_{PHL}$ | Propagation Delay, Low-High | 3003 | $V_{CC}$ = 5.0V, $R_L$ = 8TTL loads | | | 10.0 | µs |
| $t_{PHL}$ | Propagation Delay, High-Low | 3003 | $V_{CC}$ = 5.0V, $R_L$ = 8TTL loads | | | 10.0 | µs |

(5) Light Source is a gallium arsenide light emitting diode with a typical rise time of 500 nanoseconds.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

## Group B Inspection

(Performed on each inspection lot)

| Examination or Test | MIL-STD-883 Method | MIL-STD-883 Conditions | LTPD |
|---|---|---|---|
| **Subgroup 1** | | | 2 devices 0 failures |
| Physical Dimensions | 2016 | | |
| **Subgroup 2** | | | 4 devices 0 failures |
| Resistance To Solvents | 2015 | | |
| **Subgroup 3** | | | 1 device 0 failures |
| Solderability | 2003 | Soldering Temperature = 260°C ± 10°C | |
| **Subgroup 5** | | | 2 devices 0 failures |
| Bond Strength | 2011 | Condition C or D | |
| **Subgroup 7** | | | 5 |

## Group C Inspection Die Related Tests

(Performed every 3 months)

| Examination or Test | MIL-STD-883 Method | MIL-STD-883 Conditions | LTPD |
|---|---|---|---|
| **Subgroup 1** | | | 15 |
| Temperature Cycling | 1010 | Condition C, 10 cycles, -65°C to +150°C, 10 minutes max @ extremes, 5 minutes max transfer time | |
| Constant Acceleration | 2001 | Condition E, 30K G's, $Y_1$ only for 1 minute | |
| Hermetic Seal | 1014 | | |
| Fine Leak | | Condition A or B, $5 \times 10^{-8}$atm cc/sec | |
| Gross Leak | | Condition C, D or E | |
| End Points | | Group A, Subgroup 1 | |
| **Subgroup 2** | | | 5 |
| Steady State Life | 1005 | $V_{CC}$ = 5.0V, $T_A$ = 150°C, t = 1000hrs | |
| End Points | | Group A, Subgroup 1 | |

# Type OPL800TXV

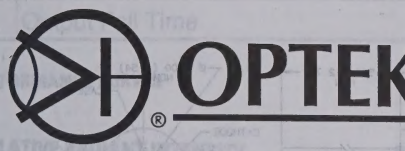
**Group D Package Related Tests** (performed every 6 months while in production)

| Examination or Test | MIL-STD-883 | | LTPD |
|---|---|---|---|
| | Method | Conditions | |
| **Subgroup 1** | | | 15 |
| Physical Dimensions | 2016 | | |
| **Subgroup 2** | | | 15 |
| Lead Integrity | 2004 | Condition B2 (Lead Fatique) | |
| Hermetic Seal<br>Fine Leak<br>Gross Leak | 1014 | <br>Condition A or B, 5 X $10^{-8}$ atm cc/sec<br>Condition C, D, or E | |
| **Subgroup 3** | | | 15 |
| Thermal Shock | 1011 | Condition B, 15 cycles, 125°C to -55°C, 5 minutes minimum @ extremes, 10 sec maximum transfer time | |
| Temperature Cycling | 1010 | Condition C, 100 cycles, -65°C to +150°C, 10 minutes minimum @ extremes, 5 minimum transfer time | |
| Moisture Resistance | 1004 | | |
| Hermetic Seal<br>Fine Leak<br>Gross Leak | 1014 | <br>Condition A or B, 5 X $10^{-7}$ atm cc/sec<br>Condition C, D, or E | |
| End Points | | Group A, Subgroup 1 | |
| **Subgroup 4** | | | 15 |
| Mechanical Shock | 2002 | Condition B | |
| Vibration, Variable Frequency | 2007 | Condition A | |
| Constant Acceleration | 2001 | Condition E, 30K G's, Y1 only for 1 minute | |
| Hermetic Seal<br>Fine Leak<br>Gross Leak | 1014 | <br>Condition A or B, 5 X $10^{-8}$ atm cc/sec<br>Condition C, D, or E | |
| End Points | | Group A, Subgroup 1 | |
| **Subgroup 5** | | | 15 |
| Salt Atmosphere | 1009 | Condition A | |
| Hermetic Seal<br>Fine Leak<br>Gross Leak | 1014 | <br>Condition A or B, 5 X $10^{-8}$ atm cc/sec<br>Condition C, D, or E | |



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396



OPTEK TECHNOLOGY, INC.



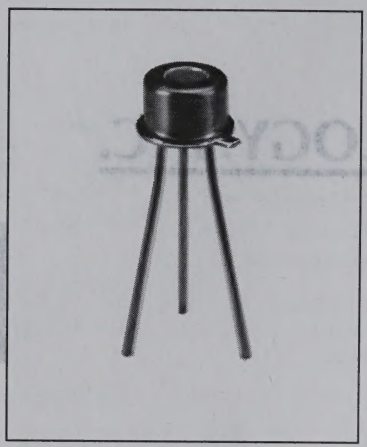
# HI-REL FIBER OPTIC COMPONENTS

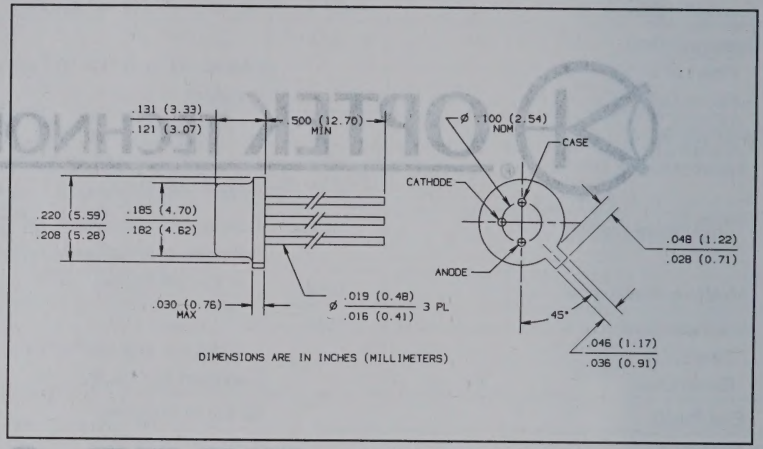
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# High Reliability
## Fiber Optic GaAlAs LED
## Types OMF320TX, OMF320TXV






### Features

- High radiant output for fiber optic applications
- High speed
- Electrically isolated from case
- Processing patterned after JANTX or JANTXV of MIL-S-19500

### Description

The OMF320 LED provides fiber optic users with high coupled power and wide bandwidth in an easily mounted hermetic package.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +150°C
Operating Temperature Range ..... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50µm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C .
(5) Prebias @ 5mA current.

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Typical Coupled Power $I_F$ = 100 mA @ 25°C | | | |
|---|---|---|---|
| **Fiber** | **Refractive Indexs** | **N.A.** | **OMF320TX/TXV** |
| 50/125µm | Graded | 0.20 | 19µW |
| 62.5/125µm | Graded | 0.28 | 34µW |
| 100/140µm | Graded | 0.29 | 96µW |
| 200/300µm* | Step | 0.41 | 360µW |

*PCS - Plastic Clad Silica

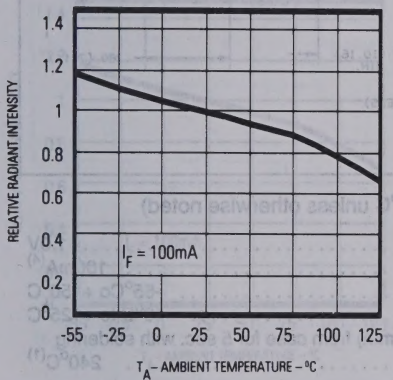
# Types OMF320TX, OMF320TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

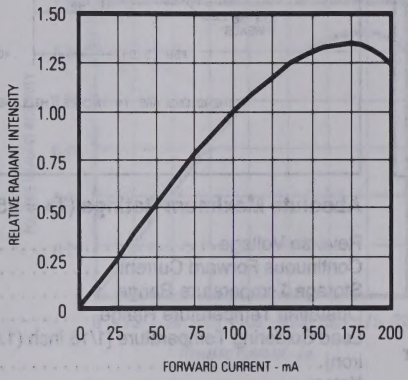
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | 15.0 | 19.0 | | µW | $I_F$ = 100 mA(2) |
| $V_F$ | Forward Voltage | | 1.7 | 2.0 | V | $I_F$ = 100 mA |
| λp | Peak Output Wavelength | 830 | 850 | 870 | nm | $I_F$ = 50 mA |
| B | Spectral Bandwidth Between Half Power Points | | 35 | | nm | $I_F$ = 50 mA |
| $t_r$ | Output Rise Time | | 6.0 | 8.0 | ns | $I_F$ = 100 mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | 6.0 | 10.0 | ns | $I_F$ = 100 mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

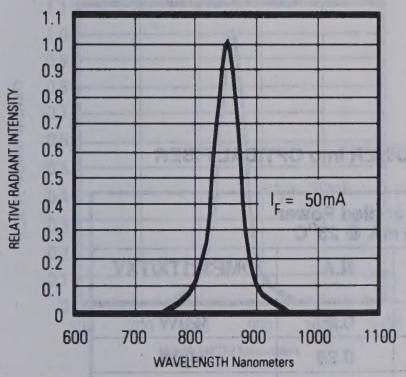
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



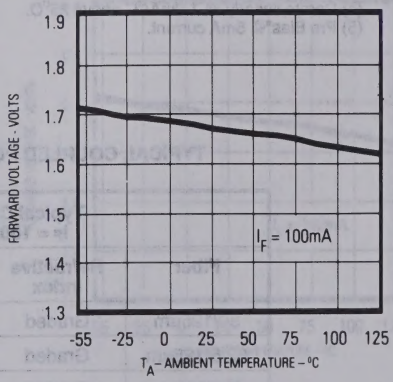

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

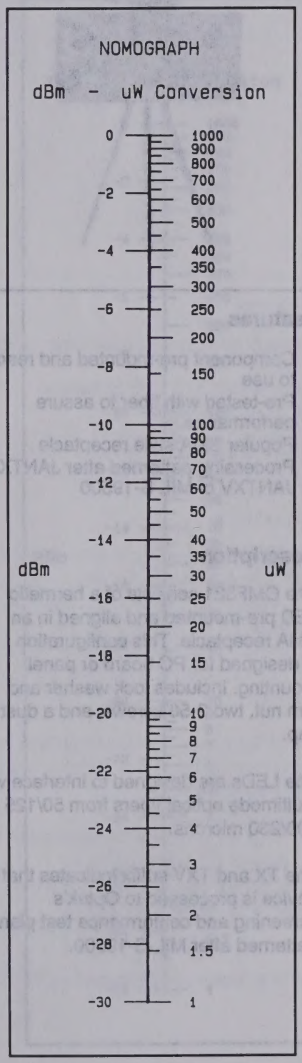



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



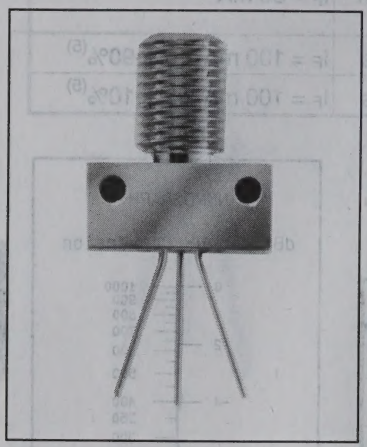



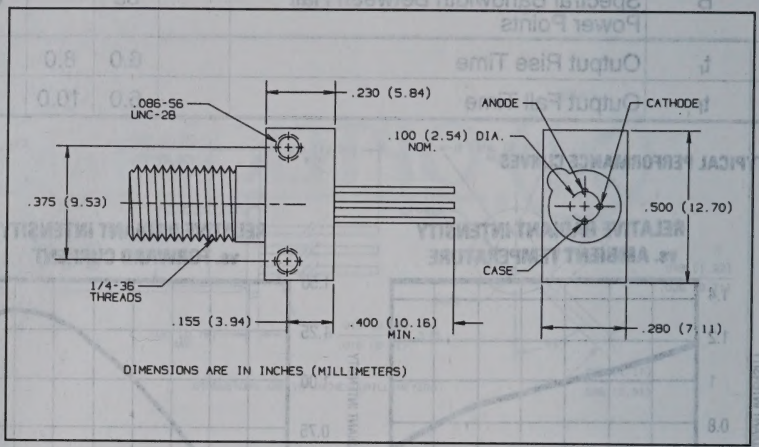

HI REL FIBER OPTICS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# High Reliability
## Fiber Optic GaAlAs LED in SMA Receptacle
## Types OMF321TX, OMF321TXV






### Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- Processing patterned after JANTX or JANTXV of MIL-S-19500

### Description

The OMF321 consists of a hermetic LED pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 1.0V |
| Continuous Forward Current | 100mA(4) |
| Storage Temperature Range | -55°Co +150°C |
| Operating Temperature Range | -40°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50µm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Pre Bias @ 5mA current.

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Typical Coupled Power $I_F$ = 100 mA @ 25°C | | | |
|---|---|---|---|
| **Fiber** | **Refractive Index** | **N.A.** | **OMF321TX/TXV** |
| 50/125µm | Graded | 0.20 | 19µW |
| 62.5/125µm | Graded | 0.28 | 34µW |
| 100/140µm | Graded | 0.29 | 96µW |
| 200/300µm* | Step | 0.41 | 360µW |

*PCS - Plastic Clad Silica

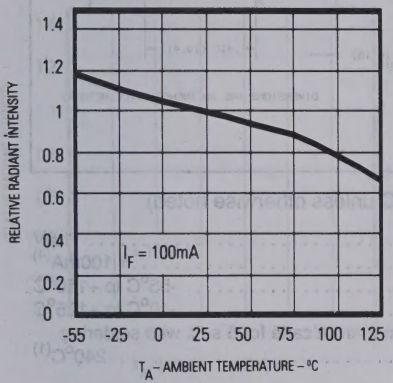
# Types OMF321TX, OMF321TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

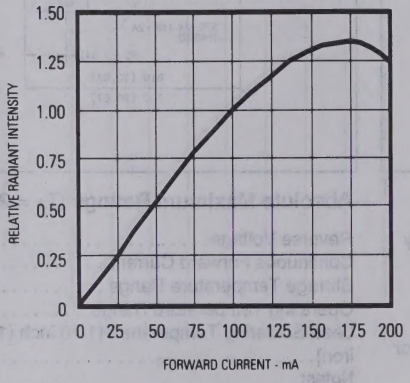
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | 15.0 | 19.0 | | µW | $I_F$ = 100 mA(2) |
| $V_F$ | Forward Voltage | | 1.7 | 2.0 | V | $I_F$ = 100 mA |
| λp | Peak Output Wavelength | 830 | 850 | 870 | nm | $I_F$ = 50 mA |
| B | Spectral Bandwidth Between Half Power Points | | 35 | | nm | $I_F$ = 50 mA |
| $t_r$ | Output Rise Time | | 6.0 | 8.0 | ns | $I_F$ = 100 mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | 6.0 | 10.0 | ns | $I_F$ = 100 mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

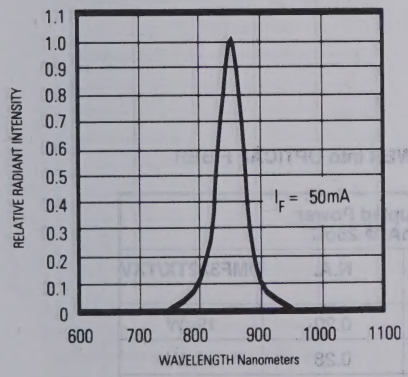
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



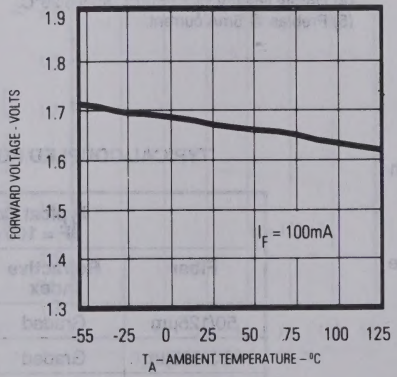

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

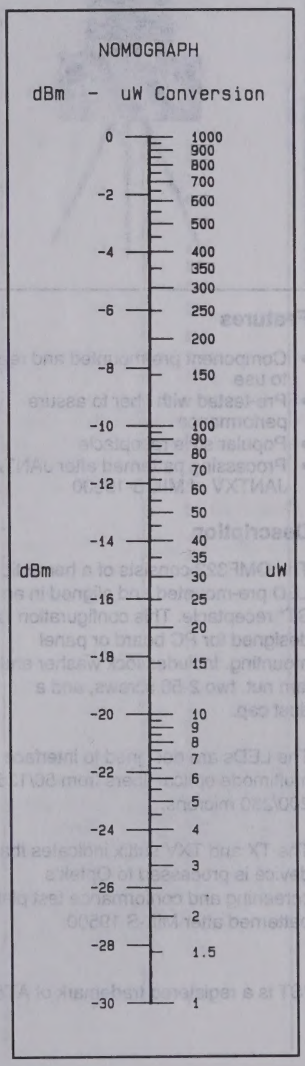



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



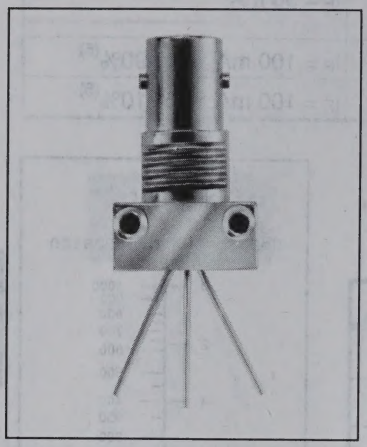



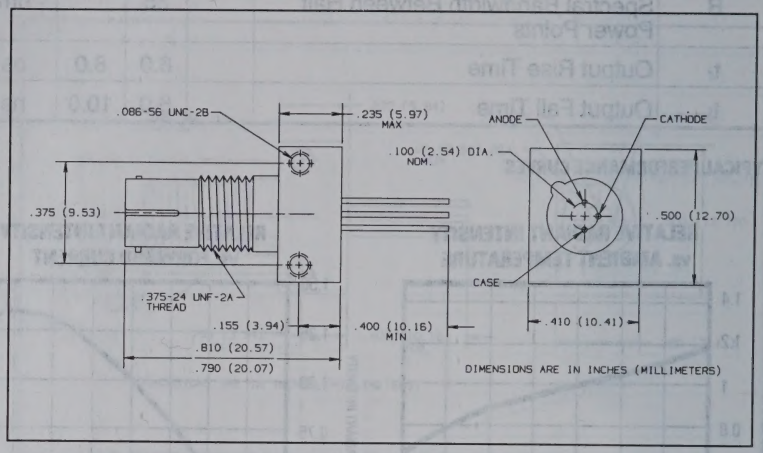

HI REL FIBER OPTICS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

# High Reliability
## Fiber Optic GaAlAs LED in ST* Compatible Receptacle
## Types OMF322TX, OMF322TXV






### Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- Processing patterned after JANTX or JANTXV of MIL-S-19500

### Description

The OMF322 consists of a hermetic LED pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S 19500.

*ST is a registered trademark of AT&T

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 1.0V |
| Continuous Forward Current | 100mA(4) |
| Storage Temperature Range | -55°C to +150°C |
| Operating Temperature Range | -40°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50µm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Typical Coupled Power IF = 100 mA @ 25oC | | | |
|---|---|---|---|
| **Fiber** | **Refractive Index** | **N.A.** | **OMF322TX/TXV** |
| 50/125µm | Graded | 0.20 | 19µW |
| 62.5/125µm | Graded | 0.28 | 34µW |
| 100/140µm | Graded | 0.29 | 95µW |
| 200/300µm* | Step | 0.41 | 360µW |

*PCS - Plastic Clad Silica

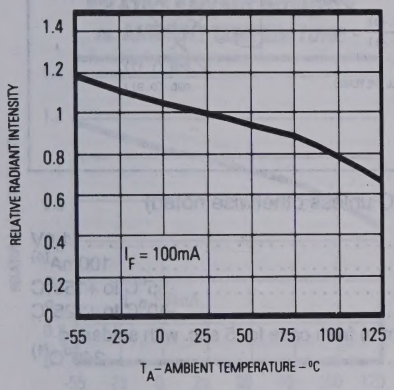
# Types OMF322TX, OMF322TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

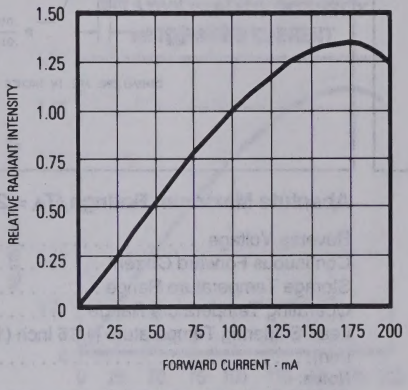
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | 15.0 | 19.0 | | µW | $I_F$ = 100 mA(2) |
| $V_F$ | Forward Voltage | | 1.7 | 2.0 | V | $I_F$ = 100 mA |
| λp | Peak Output Wavelength | 830 | 850 | 870 | nm | $I_F$ = 50 mA |
| B | Spectral Bandwidth Between Half Power Points | | 35 | | nm | $I_F$ = 50 mA |
| $t_r$ | Output Rise Time | | 6.0 | 8.0 | ns | $I_F$ = 100 mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | 6.0 | 10.0 | ns | $I_F$ = 100 mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

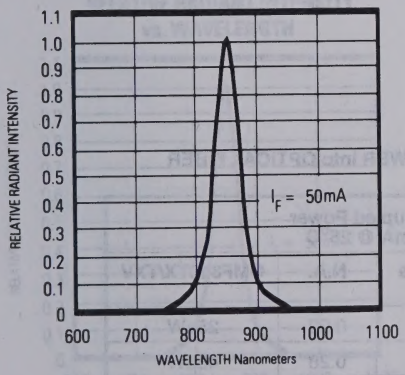
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



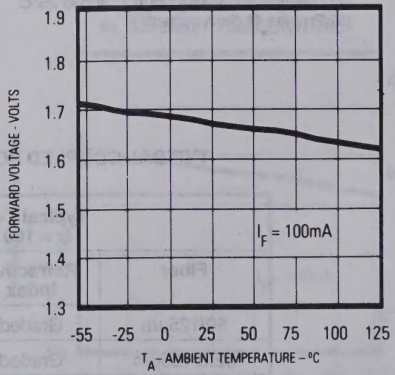

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

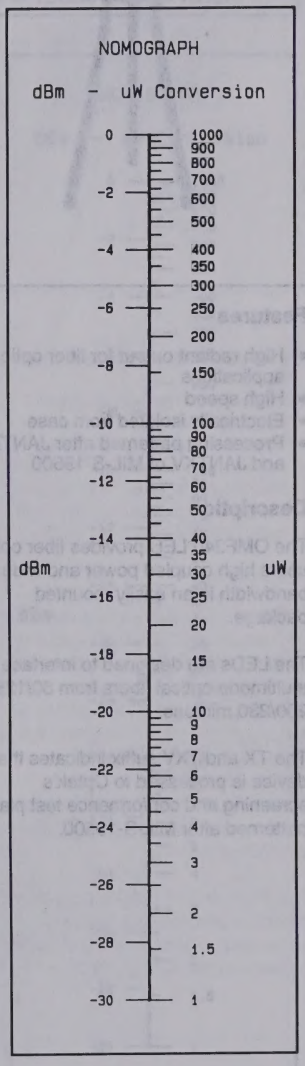



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



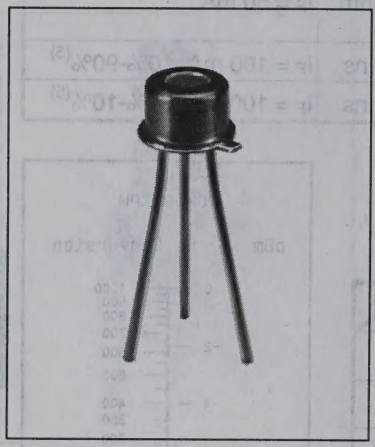

HI REL FIBER OPTICS

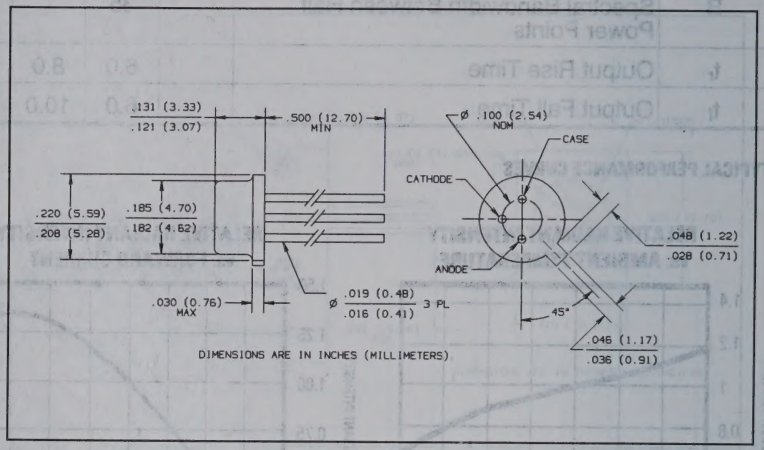
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# High Reliability
## Fiber Optic GaAlAs High Speed LED
## Types OMF340TX, OMF340TXV






### Features

- High radiant output for fiber optic applications
- High speed
- Electrically isolated from case
- Processing patterned after JANTX and JANTXV of MIL-S-19500

### Description

The OMF340 LED provides fiber optic users high coupled power and wide bandwidth in an easily mounted package.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +150°C
Operating Temperature Range ..... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50µm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Typical Coupled Power $I_F$ = 100 mA @ 25°C | | | |
|---|---|---|---|
| **Fiber** | **Refractive Index** | **N.A.** | **OMF340TX/TXV** |
| 50/125µm | Graded | 0.20 | 25µW |
| 62.5/125µm | Graded | 0.28 | 45µW |
| 100/140µm | Graded | 0.29 | 125µW |
| 200/300µm* | Step | 0.41 | 475µW |

*PCS - Plastic Clad Silica

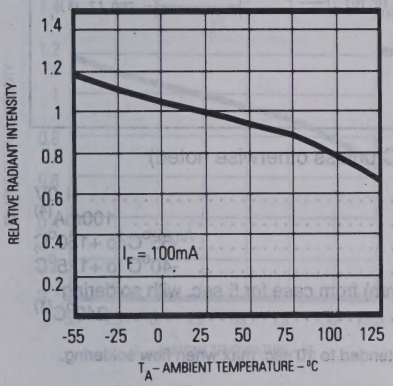
# Types OMF340TX, OMF340TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

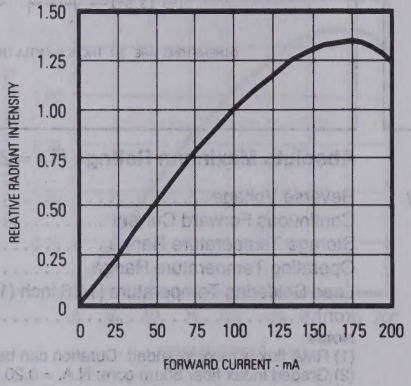
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | 20.0 | 25.0 | | µW | $I_F$ = 100mA[2] |
| $V_F$ | Forward Voltage | | 1.7 | 2.0 | V | $I_F$ = 100mA |
| λp | Peak Output Wavelength | 830 | 850 | 870 | nm | $I_F$ = 50mA |
| B | Spectral Bandwidth Between Half Power Points | | 35 | | nm | $I_F$ = 50mA |
| $t_r$ | Output Rise Time | | 4.5 | 6.0 | ns | $I_F$ = 100mA, 10%-90%[5] |
| $t_f$ | Output Fall Time | | 4.5 | 6.0 | ns | $I_F$ = 100mA, 90%-10%[5] |

**TYPICAL PERFORMANCE CURVES**

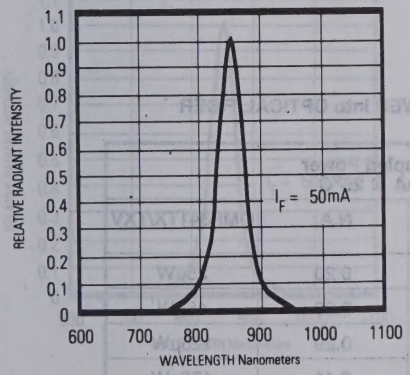
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



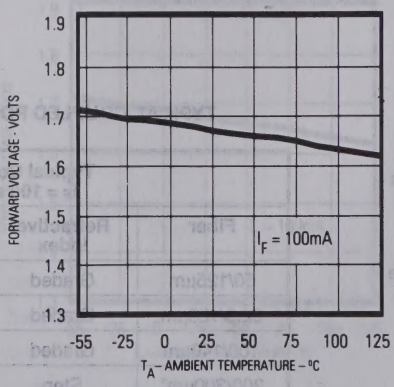

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

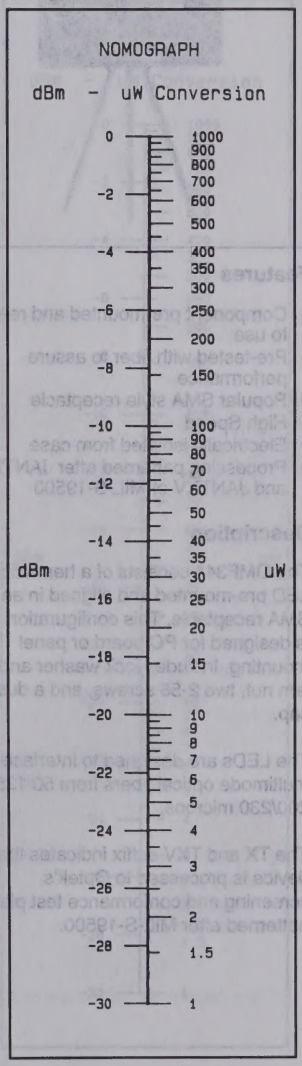



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



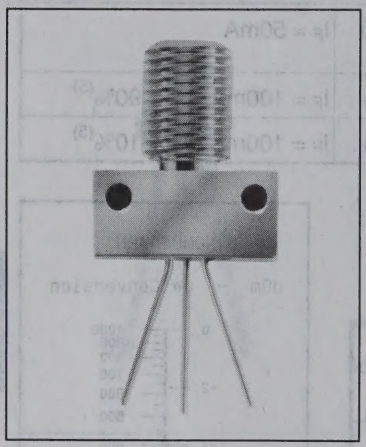



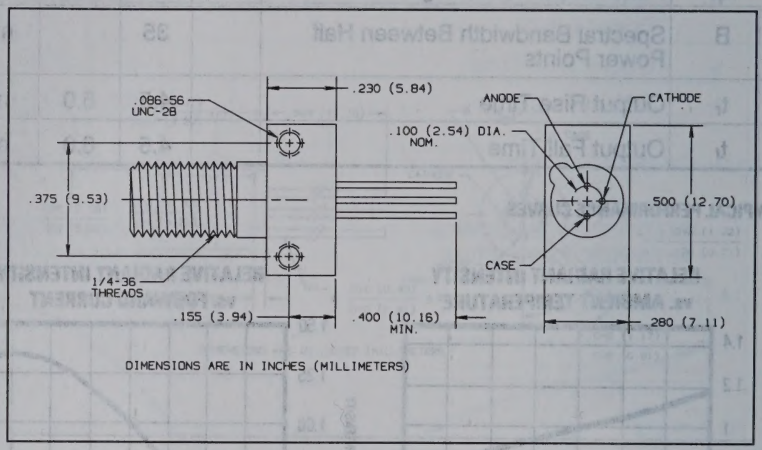

HI REL FIBER OPTICS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

# High Reliability
## Fiber Optic GaAlAs High Speed LED in SMA Receptacle
## Types OMF341TX, OMF341TXV






### Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- High Speed
- Electrically isolated from case
- Processing patterned after JANTX and JANTXV of MIL-S-19500

### Description

The OMF341 consists of a hermetic LED pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 1.0V |
| Continuous Forward Current | 100mA(4) |
| Storage Temperature Range | -55°C to +150°C |
| Operating Temperature Range | -40°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50µm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

### TYPICAL COUPLED POWER into OPTICAL FIBER

| Typical Coupled Power $I_F$ = 100 mA @ 25°C | | | |
|---|---|---|---|
| **Fiber** | **Refractive Index** | **N.A.** | **OMF341TX/TXV** |
| 50/125µm | Graded | 0.20 | 25µW |
| 62.5/125µm | Graded | 0.28 | 45µW |
| 100/140µm | Graded | 0.29 | 125µW |
| 200/300µm* | Step | 0.41 | 475µW |

*PCS - Plastic Clad Silica

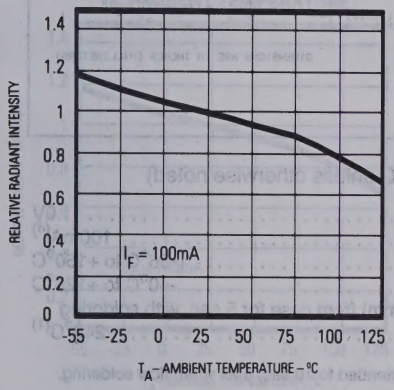
# Types OMF341TX, OMF341TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

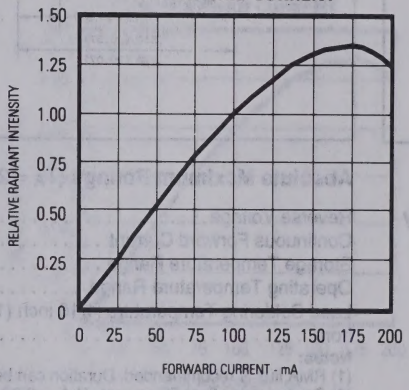
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | 20.0 | 25.0 | | µW | $I_F$ = 100 mA(2) |
| $V_F$ | Forward Voltage | | 1.7 | 2.0 | V | $I_F$ = 100 mA |
| λp | Peak Output Wavelength | 830 | 850 | 870 | nm | $I_F$ = 50 mA |
| B | Spectral Bandwidth Between Half Power Points | | 35 | | nm | $I_F$ = 50 mA |
| $t_r$ | Output Rise Time | | 4.5 | 6.0 | ns | $I_F$ = 100 mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | 4.5 | 6.0 | ns | $I_F$ = 100 mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

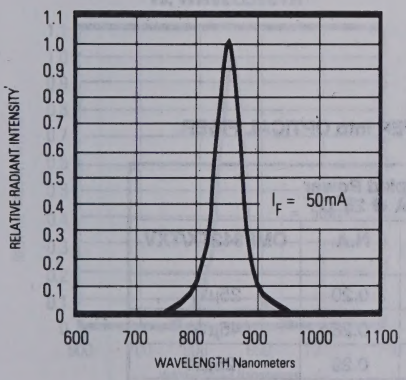
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



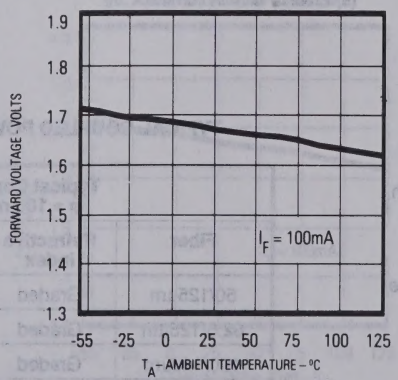

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

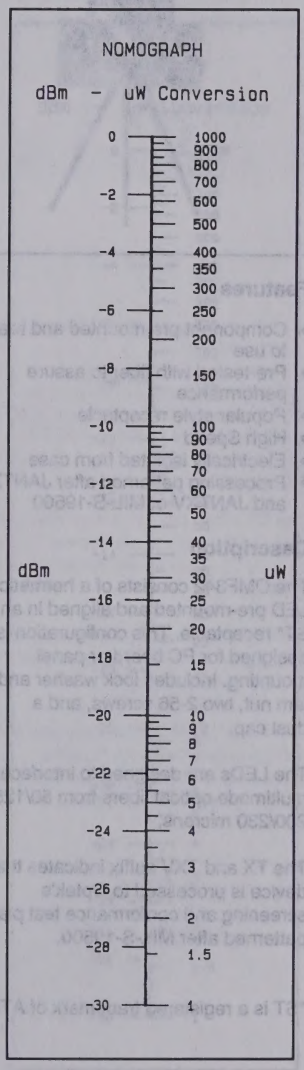



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



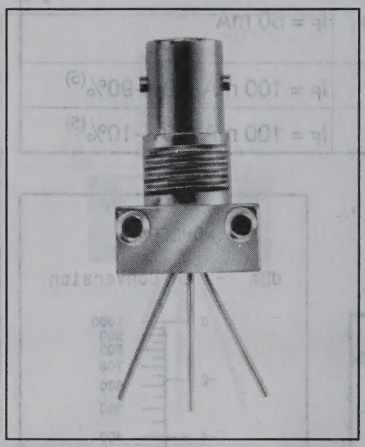



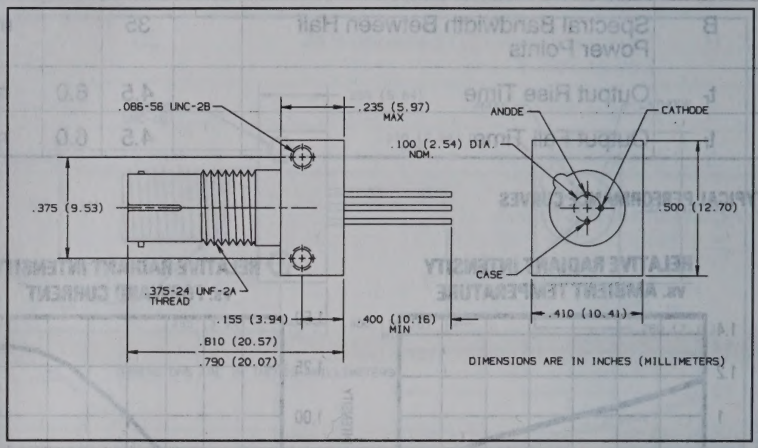

HI REL FIBER OPTICS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# High Reliability
## Fiber Optic GaAlAs High Speed LED Types OMF342TX, OMF342TXV

**in ST* Compatible Receptacle**






### Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- High Speed
- Electrically isolated from case
- Processing patterned after JANTX and JANTXV of MIL-S-19500

### Description

The OMF342 consists of a hermetic LED pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

*ST is a registered trademark of AT&T

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 1.0V |
| Continuous Forward Current | 100mA(4) |
| Storage Temperature Range | -55°C to +150°C |
| Operating Temperature Range | -40°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50µm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Typical Coupled Power $I_F$ = 100 mA @ 25°C | | | |
|---|---|---|---|
| **Fiber** | **Refractive Index** | **N.A.** | **OMF342TX/TXV** |
| 50/125µm | Graded | 0.20 | 25µW |
| 62.5/125µm | Graded | 0.28 | 45µW |
| 100/140µm | Graded | 0.29 | 125µW |
| 200/300µm* | Step | 0.41 | 475µW |

*PCS - Plastic Clad Silica

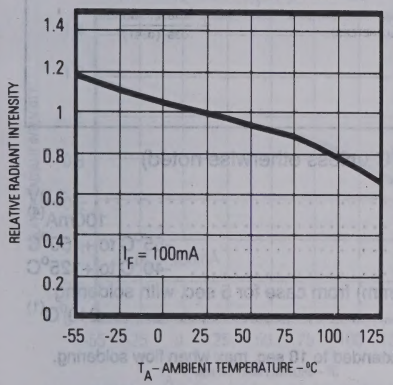
# Types OMF342TX, OMF342TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

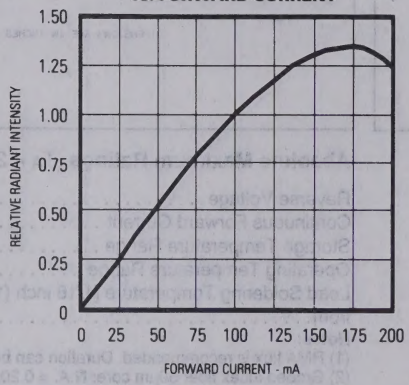
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | 20.0 | 25.0 | | µW | $I_F$ = 100 mA(2) |
| $V_F$ | Forward Voltage | | 1.7 | 2.0 | V | $I_F$ = 100 mA |
| λp | Peak Output Wavelength | 830 | 850 | 870 | nm | $I_F$ = 50 mA |
| B | Spectral Bandwidth Between Half Power Points | | 35 | | nm | $I_F$ = 50 mA |
| $t_r$ | Output Rise Time | | 4.5 | 6.0 | ns | $I_F$ = 100 mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | 4.5 | 6.0 | ns | $I_F$ = 100 mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

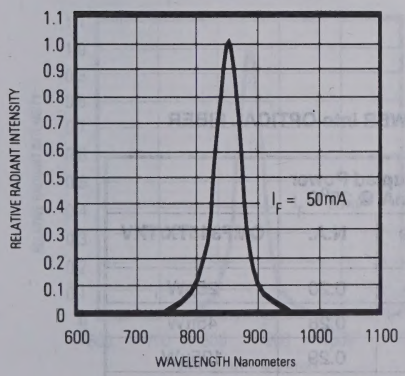
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



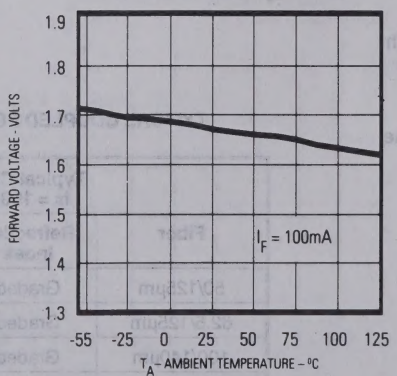

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

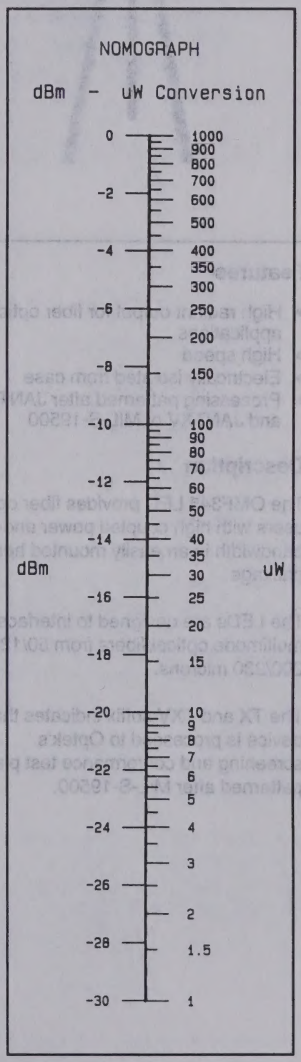



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



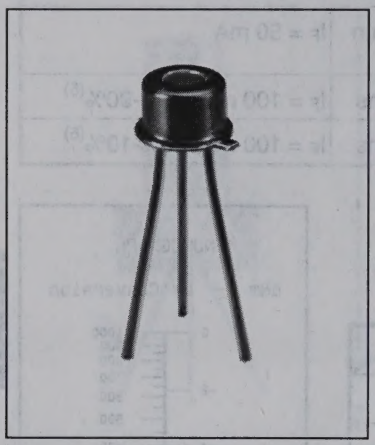



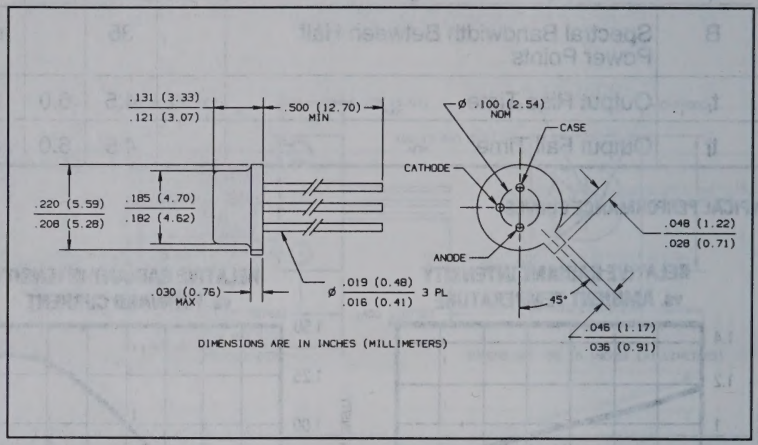



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# High Reliability
## Fiber Optic GaAlAs High Speed LED
## Types OMF345TX, OMF345TXV






### Features

- High radiant output for fiber optic applications
- High speed
- Electrically isolated from case
- Processing patterned after JANTX and JANTXV of MIL-S-19500

### Description

The OMF345 LED provides fiber optic users with high coupled power and wide bandwidth in an easily mounted hermetic package.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +150°C
Operating Temperature Range ..... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50µm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

**TYPICAL COUPLED POWER into OPTICAL FIBER**

| Typical Coupled Power $I_F$ = 100 mA @ 25°C | | | |
|---|---|---|---|
| **Fiber** | **Refractive Index** | **N.A.** | **OMF345TX/TXV** |
| 50/125µm | Graded | 0.20 | 25µW |
| 62.5/125µm | Graded | 0.28 | 45µW |
| 100/140µm | Graded | 0.29 | 125µW |
| 200/300µm* | Step | 0.41 | 475µW |

*PCS - Plastic Clad Silica

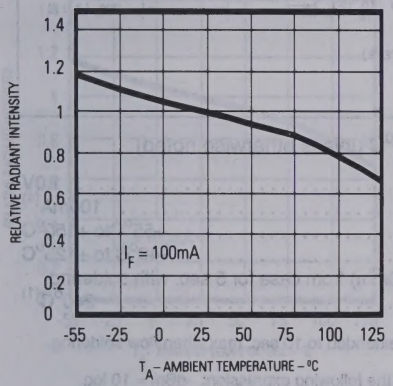
# Types OMF345TX, OMF345TXV

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

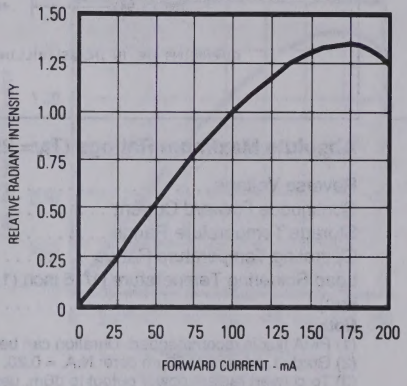
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | 20.0 | 25.0 | | µW | $I_F$ = 100 mA(2) |
| $V_F$ | Forward Voltage | | 1.7 | 2.0 | V | $I_F$ = 100 mA |
| λp | Peak Output Wavelength | 830 | 850 | 870 | nm | $I_F$ = 50 mA |
| B | Spectral Bandwidth Between Half Power Points | | 35 | | nm | $I_F$ = 50 mA |
| $t_r$ | Output Rise Time | | 3.5 | 4.5 | ns | $I_F$ = 100 mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | 3.5 | 4.5 | ns | $I_F$ = 100 mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

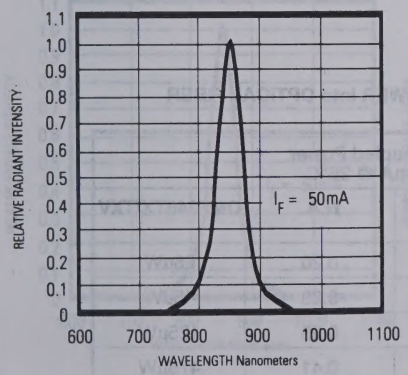
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



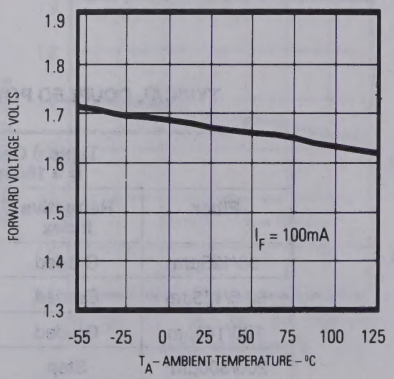

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

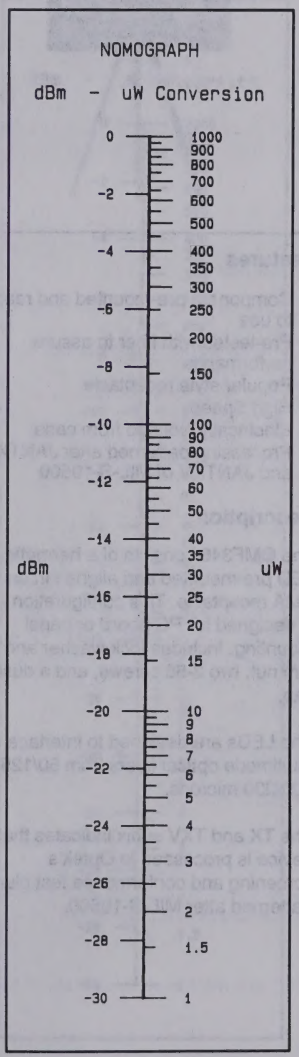



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**



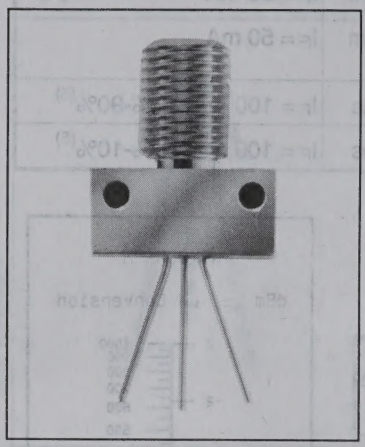

HI REL FIBER OPTICS

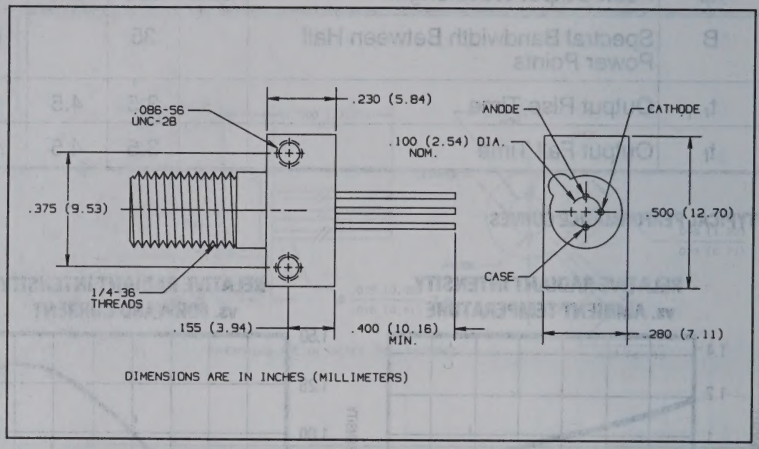
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# High Reliability
## Fiber Optic GaAlAs High Speed LED in SMA Receptacle
## Types OMF346TX, OMF346TXV






### Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- High Speed
- Electrically isolated from case
- Processing patterned after JANTX and JANTXV of MIL-S-19500

### Description

The OMF346 consists of a hermetic LED pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 1.0V |
| Continuous Forward Current | 100mA(4) |
| Storage Temperature Range | -55°C to +150°C |
| Operating Temperature Range | -40°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(1) |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50µm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

### TYPICAL COUPLED POWER into OPTICAL FIBER

| Typical Coupled Power $I_F$ = 100 mA @ 25°C | | | |
|---|---|---|---|
| **Fiber** | **Refractive Index** | **N.A.** | **OMF346TX/TXV** |
| 50/125µm | Graded | 0.20 | 25µW |
| 62.5/125µm | Graded | 0.28 | 45µW |
| 100/140µm | Graded | 0.29 | 125µW |
| 200/300µm* | Step | 0.41 | 475µW |

*PCS - Plastic Clad Silica

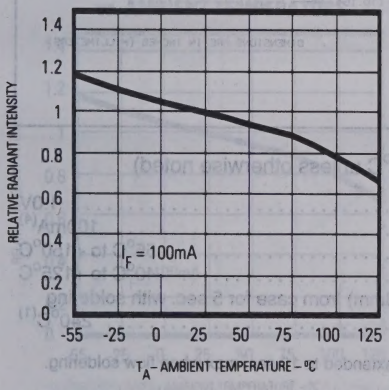
# Types OMF346TX, OMF346TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

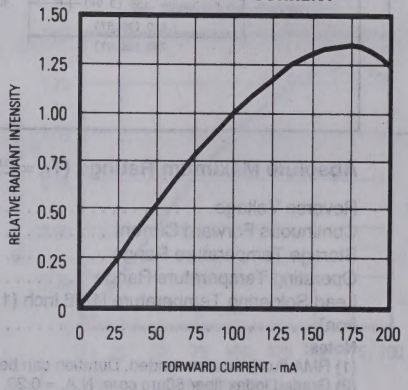
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | 20.0 | 25.0 | | µW | $I_F$ = 100 mA(2) |
| $V_F$ | Forward Voltage | | 1.7 | 2.0 | V | $I_F$ = 100 mA |
| λp | Peak Output Wavelength | 830 | 850 | 870 | nm | $I_F$ = 50 mA |
| B | Spectral Bandwidth Between Half Power Points | | 35 | | nm | $I_F$ = 50 mA |
| $t_r$ | Output Rise Time | | 3.5 | 4.5 | ns | $I_F$ = 100 mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | 3.5 | 4.5 | ns | $I_F$ = 100 mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

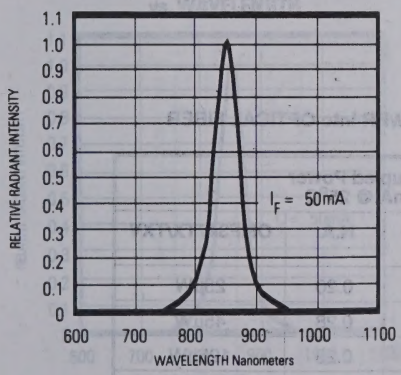
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



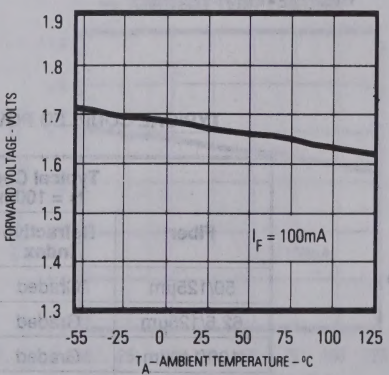

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

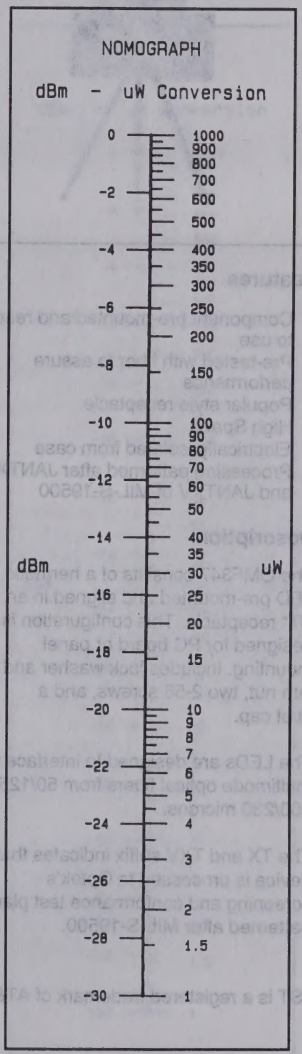



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**

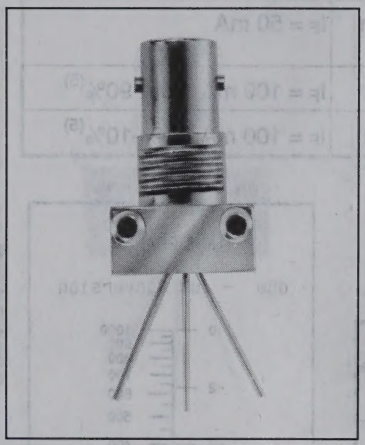


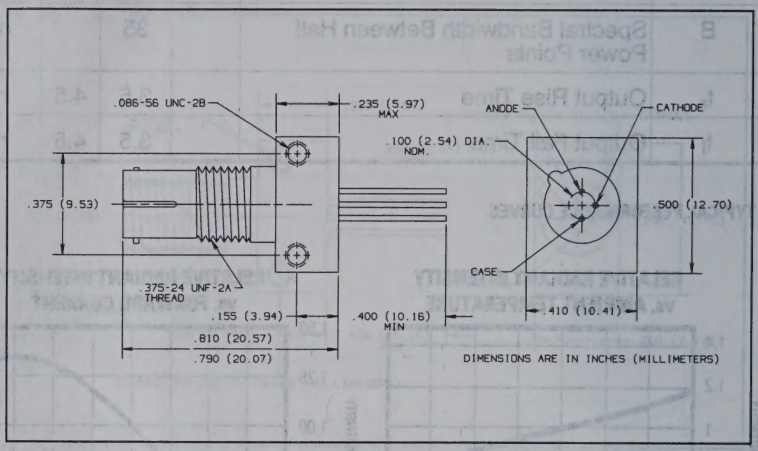




HI REL FIBER OPTICS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# High Reliability
## Fiber Optic GaAlAs High Speed LED in ST* Compatible Receptacle
## Types OMF347TX, OMF347TXV






### Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- High Speed
- Electrically isolated from case
- Processing patterned after JANTX and JANTXV of MIL-S-19500

### Description

The OMF347 consists of a hermetic LED pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

*ST is a registered trademark of AT&T

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

Reverse Voltage ..... 1.0V
Continuous Forward Current ..... 100mA(4)
Storage Temperature Range ..... -55°C to +150°C
Operating Temperature Range ..... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] ..... 240°C(1)

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50µm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current .

### TYPICAL COUPLED POWER into OPTICAL FIBER

| Typical Coupled Power $I_F$ = 100 mA @ 25°C | | | |
|---|---|---|---|
| **Fiber** | **Refractive Index** | **N.A.** | **OMF347TX/TXV** |
| 50/125µm | Graded | 0.20 | 25µW |
| 62.5/125µm | Graded | 0.28 | 45µW |
| 100/140µm | Graded | 0.29 | 125µW |
| 200/300µm* | Step | 0.41 | 475µW |

*PCS - Plastic Clad Silica

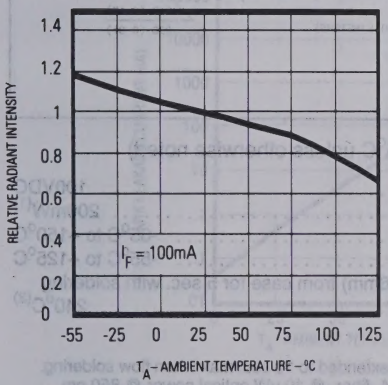
# Types OMF347TX, OMF347TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

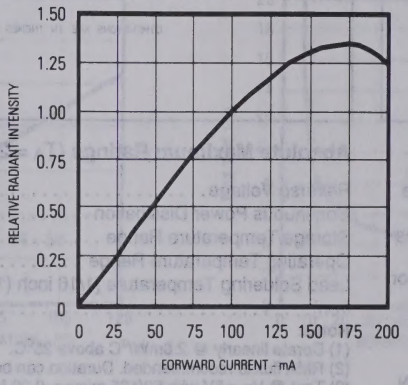
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $P_O$ | Radiant Power Output | 20.0 | 25.0 | | μW | $I_F$ = 100 mA(2) |
| $V_F$ | Forward Voltage | | 1.7 | 2.0 | V | $I_F$ = 100 mA |
| λp | Peak Output Wavelength | 830 | 850 | 870 | nm | $I_F$ = 50 mA |
| B | Spectral Bandwidth Between Half Power Points | | 35 | | nm | $I_F$ = 50 mA |
| $t_r$ | Output Rise Time | | 3.5 | 4.5 | ns | $I_F$ = 100 mA, 10%-90%(5) |
| $t_f$ | Output Fall Time | | 3.5 | 4.5 | ns | $I_F$ = 100 mA, 90%-10%(5) |

**TYPICAL PERFORMANCE CURVES**

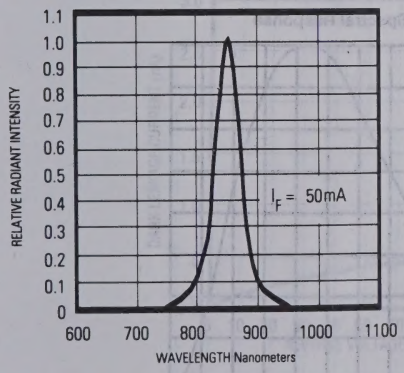
**RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE**



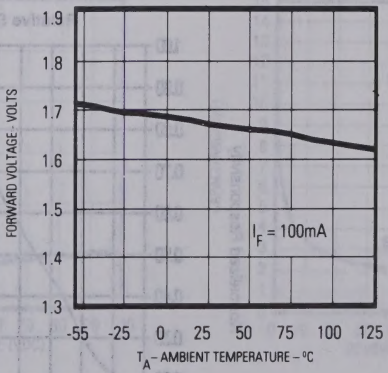

**RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT**

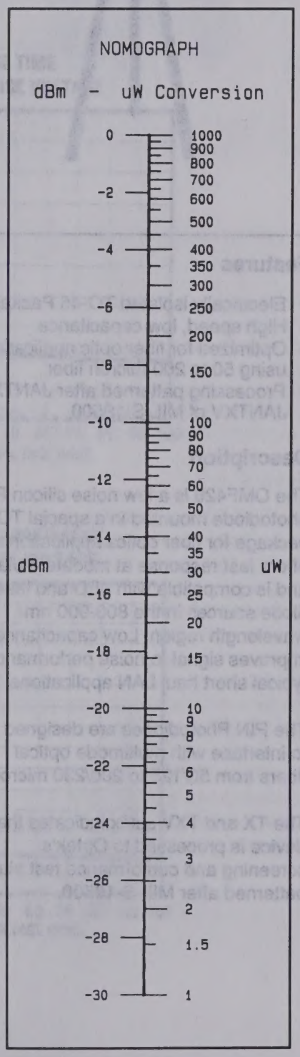



**RELATIVE RADIANT INTENSITY vs. WAVELENGTH**




**FORWARD VOLTAGE vs. AMBIENT TEMPERATURE**

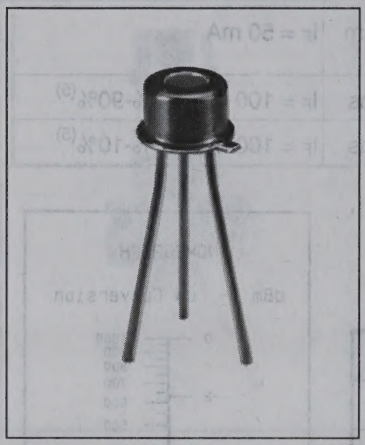


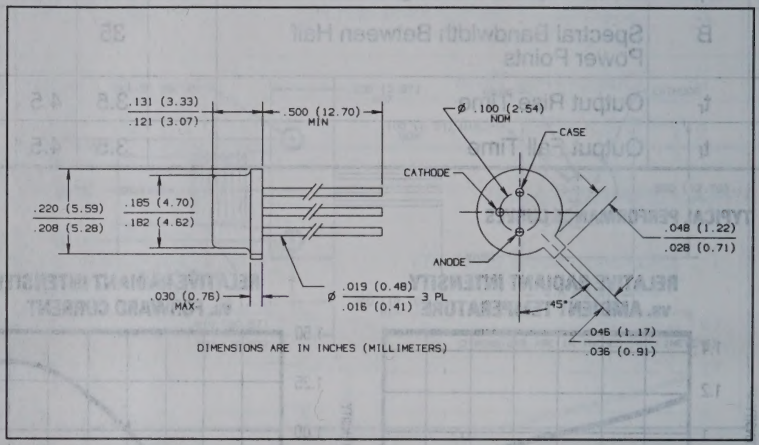




HI REL FIBER OPTICS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# High Reliability
## Fiber Optic High Speed PIN Photodiode
## Type OMF420TX, OMF420TXV






### Features

- Electrically isolated TO-46 Package
- High speed, low capacitance
- Optimized for fiber optic applications using 50 to 200 micron fiber
- Processing patterned after JANTX or JANTXV of MIL-S-19500

### Description

The OMF420 is a low noise silicon PIN photodiode mounted in a special TO-46 package for fiber optics applications. It offers fast response at moderate bias and is compatible with LED and laser diode sources in the 800-900 nm wavelength region. Low capacitance improves signal to noise performance in typical short haul LAN applications.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

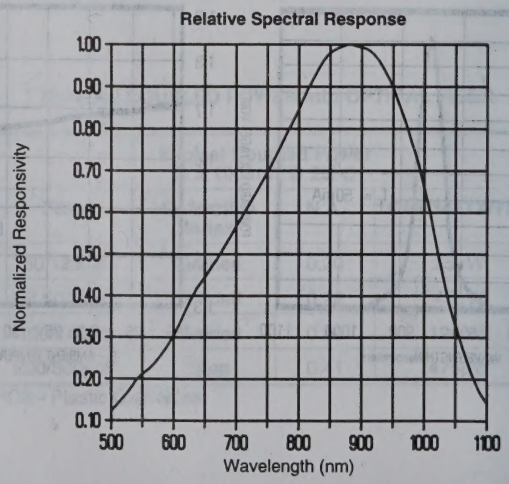
The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.
(4) $R_L$ = 50 Ω 10%-90%.

### Typical Performance Curves



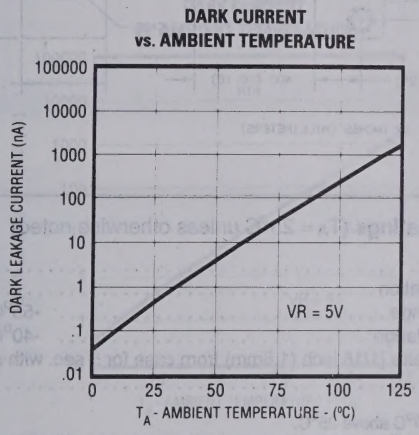

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

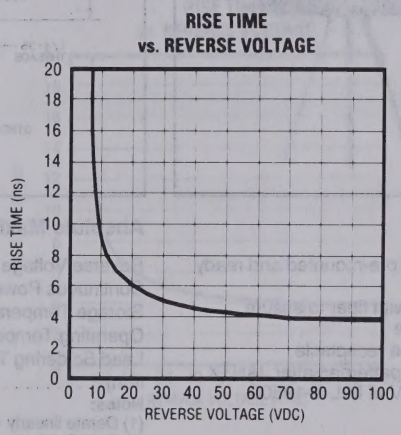
# Type OMF420TX, OMF420TXV

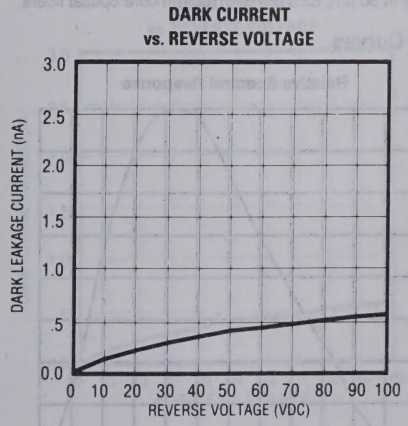
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

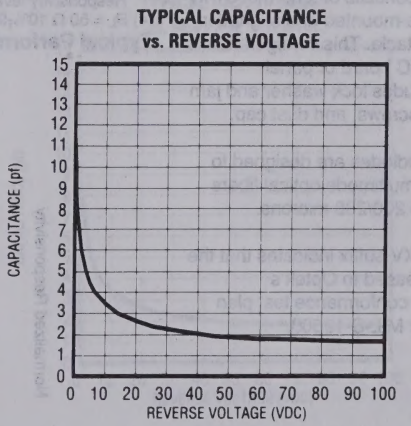
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0 V[3] |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0 V |
| λp | Peak Response Wavelength | | 880 | | nm | |
| $t_r$ | Output Rise Time | | 6.0 | | ns | $V_R$ = 15.0 V[4] |
| $C_T$ | Total Capacitance | | 3.0 | | pF | $V_R$ = 20.0 V |
| FoV | Field of View | | 80 | | Deg. | |

## Typical Performance Curves



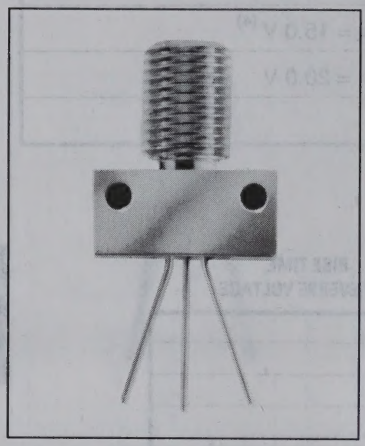


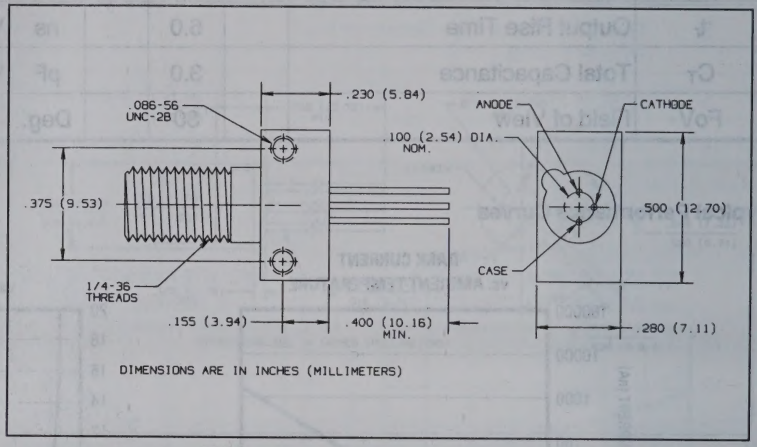

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# High Reliability
## Fiber Optic High Speed PIN Photodiode in SMA Receptacle
## Type OMF421TX, OMF421TXV






### Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- Processing patterned after JANTX and JANTXV of MIL-S-19500

### Description

The OMF421 consists of a hermetic PIN photodiode pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

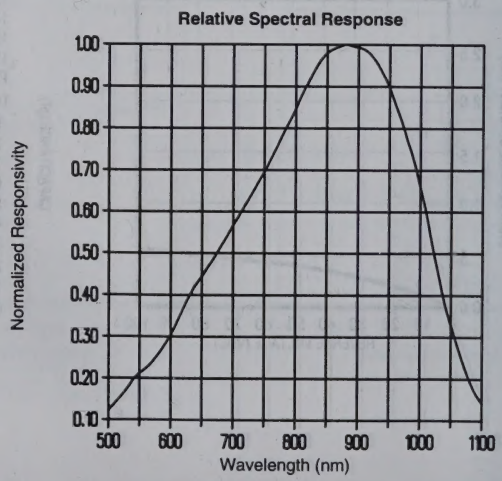
The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -55°C to +150°C |
| Operating Temperature Range | -40°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.
(4) $R_L$ = 50 Ω 10%-90%.

### Typical Performance Curves

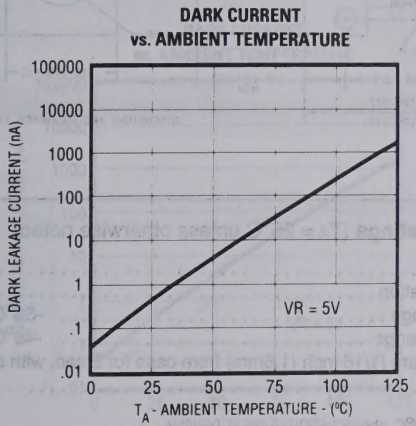


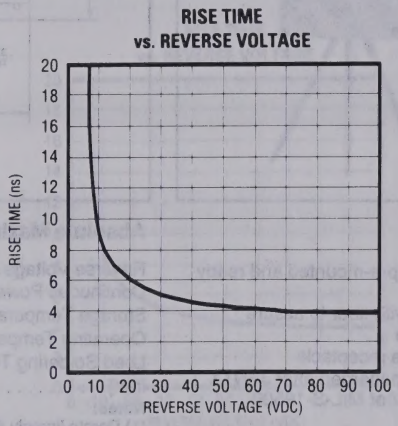
# Type OMF421TX, OMF421TXV

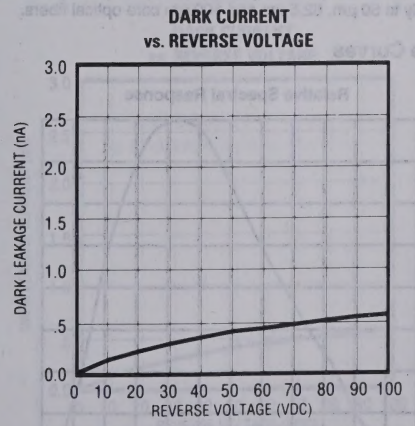
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

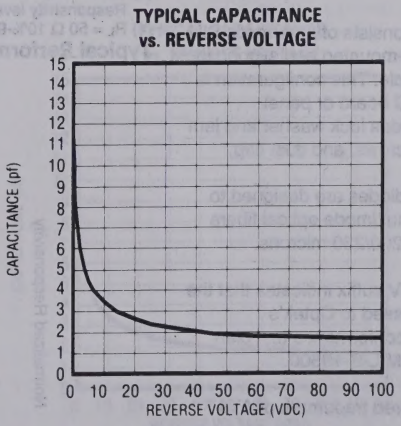
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0 V[3] |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0 V |
| λp | Peak Response Wavelength | | 880 | | nm | |
| $t_r$ | Output Rise Time | | 6.0 | | ns | $V_R$ = 15.0 V[4] |
| $C_T$ | Total Capacitance | | 3.0 | | pF | $V_R$ = 20.0 V |

**Typical Performance Curves**



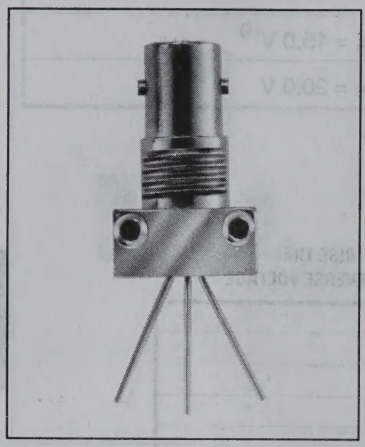


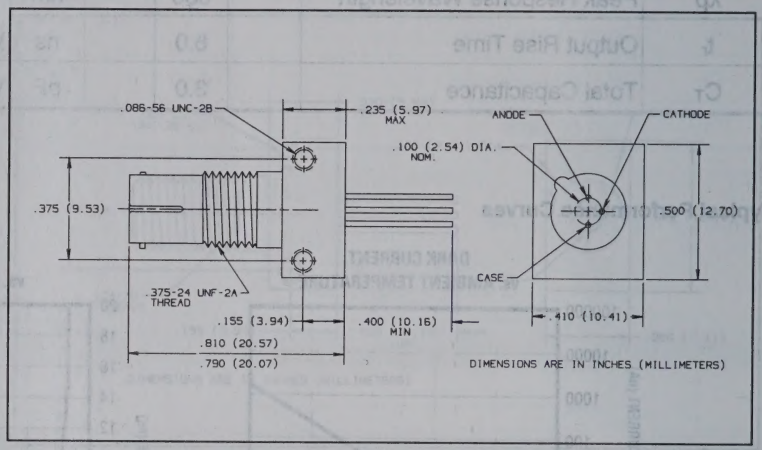

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# High Reliability
## Fiber Optic High Speed PIN Photodiode in ST* Compatible Receptacle
## Type OMF422TX, OMF422TXV






### Features

- Component pre-mounted and ready for use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- Processing patterned after JANTX and JANTXV of MIL-S-19500

### Description

The OMF422 consists of a hermetic PIN photodiode pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

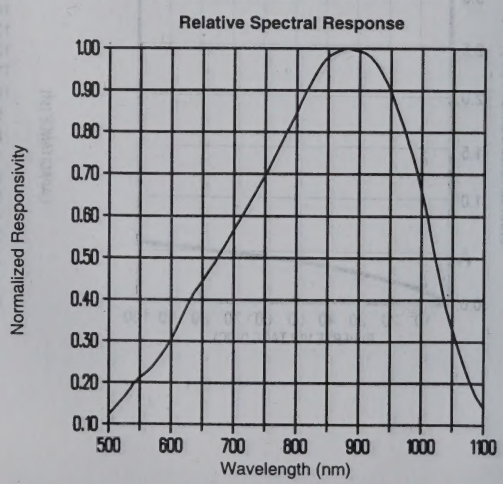
*ST is a registered trademark of AT&T

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -55°C to +150°C |
| Operating Temperature Range | -40°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.
(4) $R_L$ = 50 Ω 10%-90%.

### Typical Performance Curves



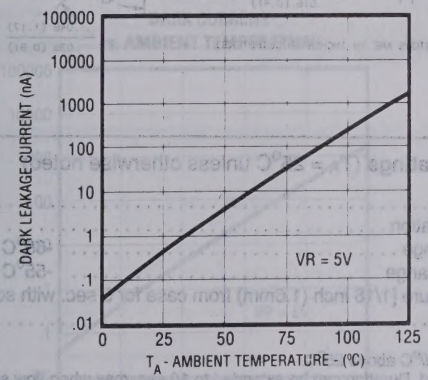
# Type OMF422TX, OMF422TXV

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

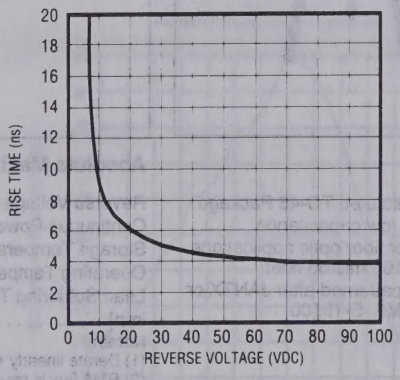
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0 V[3] |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0 V |
| λp | Peak Response Wavelength | | 880 | | nm | |
| $t_r$ | Output Rise Time | | 6.0 | | ns | $V_R$ = 15.0 V [4] |
| $C_T$ | Total Capacitance | | 3.0 | | pF | $V_R$ = 20.0 V |

## Typical Performance Curves

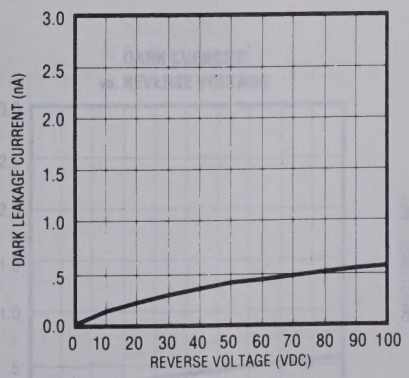
**DARK CURRENT vs. AMBIENT TEMPERATURE**



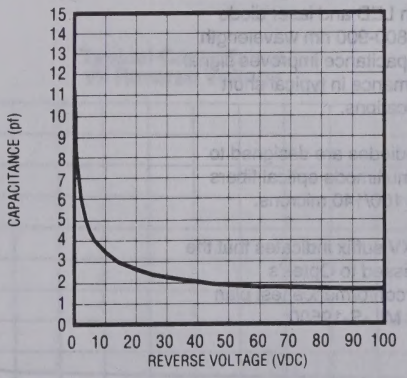

**RISE TIME vs. REVERSE VOLTAGE**




**DARK CURRENT vs. REVERSE VOLTAGE**




**TYPICAL CAPACITANCE vs. REVERSE VOLTAGE**

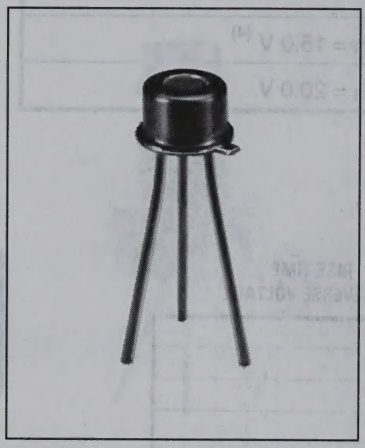


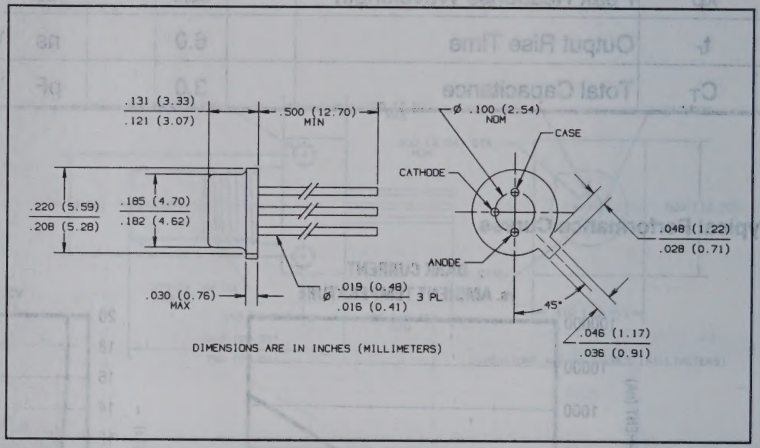



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# High Reliability
## Fiber Optic High Speed PIN Photodiode
## Type OMF430TX, OMF430TXV






### Features

- Electrically isolated TO-46 Package
- High speed, low capacitance
- Optimized for fiber optic applications using 50 to 100 micron fiber
- Processing patterned after JANTX or JANTXV of MIL-S-19500

### Description

The OMF430 is a low noise silicon PIN photodiode mounted in a special TO-46 package for fiber optics applications. It offers fast response at low bias and is compatible with LED and laser diode sources in the 800-900 nm wavelength region. Low capacitance improves signal to noise performance in typical short haul LAN applications.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | -55°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

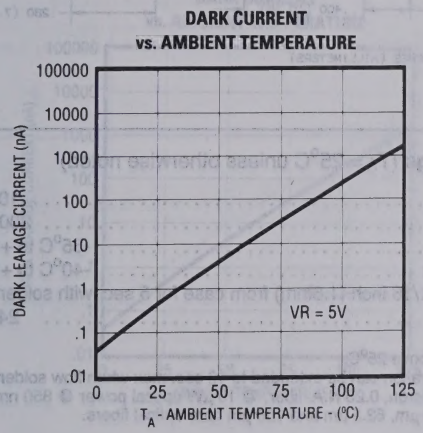
**Notes:**
(1) Derate linearly @ 2.0 mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.

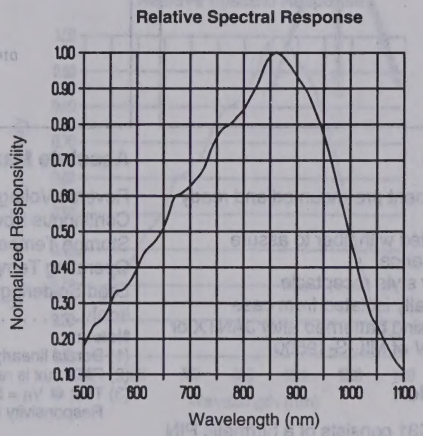
# Type OMF430TX, OMF430TXV

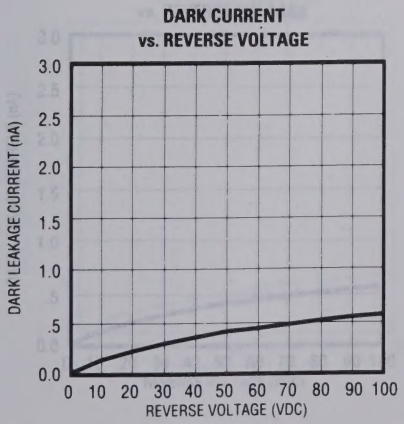
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

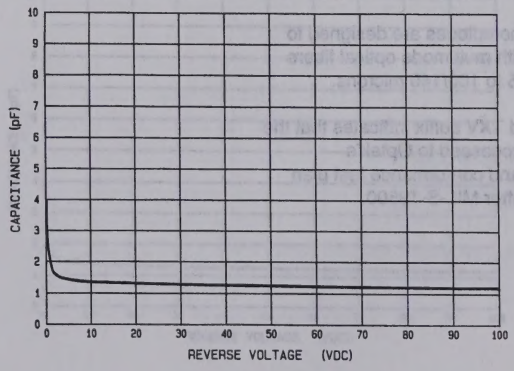
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0V(3) |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0V |
| λp | Peak Response Wavelength | | 860 | | nm | |
| tr | Output Rise Time | | 0.6 | | ns | $V_R$ = 50.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 1.0 | | ns | $V_R$ = 15.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 2.0 | | ns | $V_R$ = 5.0V, $R_L$ = 50Ω, 10%-90% |
| $C_T$ | Total Capacitance | | 1.5 | 2.0 | pF | $V_R$ = 5.0V |
| FoV | Field of View | | 80 | | Deg. | |

**Typical Performance Curves**



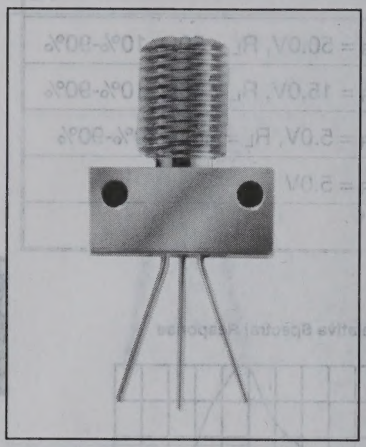


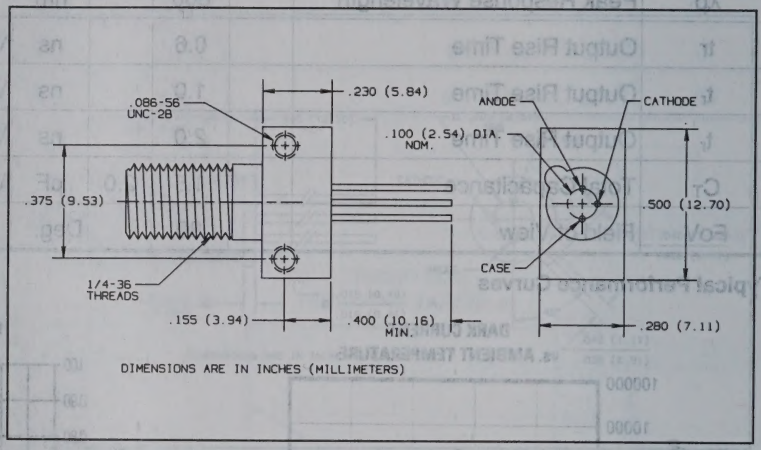

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# High Reliability
## Fiber Optic High Speed PIN Photodiode in SMA Receptacle
## Type OMF431TX, OMF431TXV






### Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- Electrically isolated from case
- Processing patterned after JANTX or JANTXV of MIL-S-19500

### Description

The OMF431 consists of a hermetic PIN photodiode pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -55°C to +150°C |
| Operating Temperature Range | -40°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

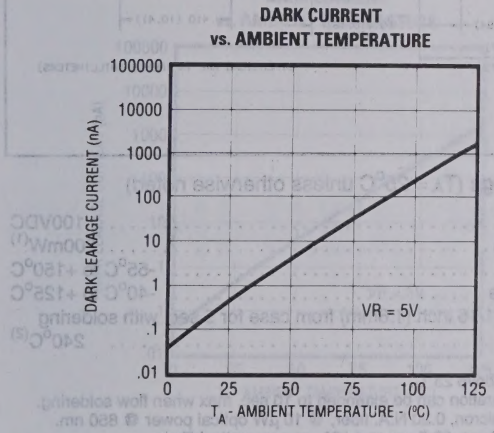
**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.

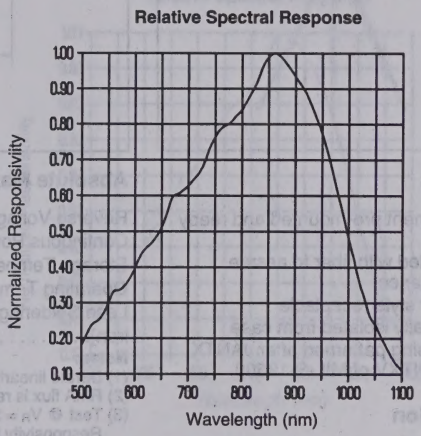
# Type OMF431TX, OMF431TXV

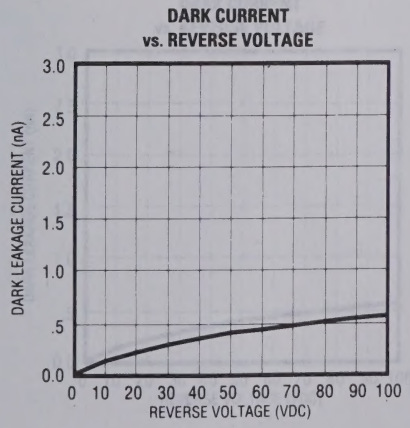
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

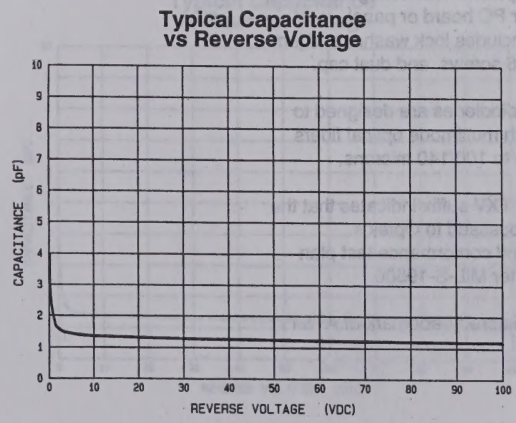
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0V(3) |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0V |
| $\lambda p$ | Peak Response Wavelength | | 860 | | nm | |
| $t_r$ | Output Rise Time | | 0.6 | | ns | $V_R$ = 50.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 1.0 | | ns | $V_R$ = 15.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 2.0 | | ns | $V_R$ = 5.0V, $R_L$ = 50Ω, 10%-90% |
| $C_T$ | Total Capacitance | | 1.5 | 2.0 | pF | $V_R$ = 5.0V |

## Typical Performance Curves



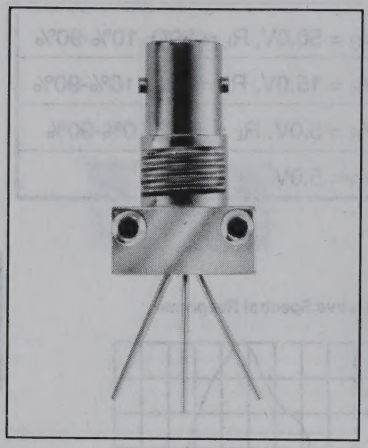


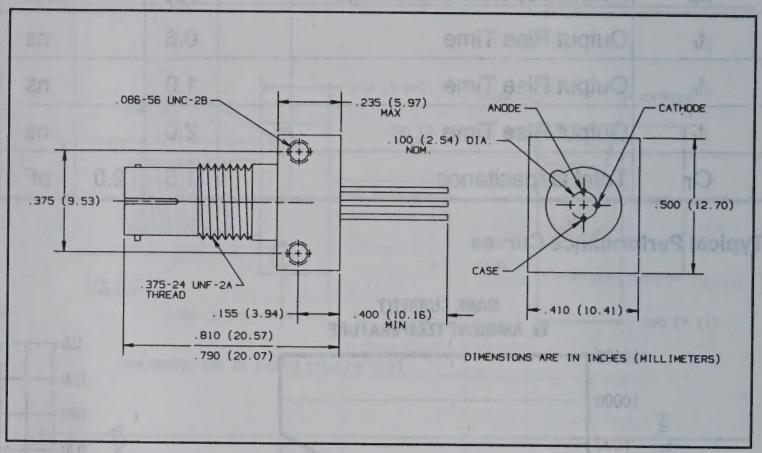

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# High Reliability
## Fiber Optic High Speed PIN Photodiode in ST* Compatible Receptacle
## Type OMF432TX, OMF432TXV






### Features

- Component pre-mounted and ready for use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- Electrically isolated from case
- Processing patterned after JANTX and JANTXV of MIL-S-19500

### Description

The OMF432 consists of a hermetic PIN photodiode pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

*ST is a registered trademark of AT&T

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Reverse Voltage | 100VDC |
| Continuous Power Dissipation | 200mW(1) |
| Storage Temperature Range | -55°C to +150°C |
| Operating Temperature Range | -40°C to +125°C |
| Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] | 240°C(2) |

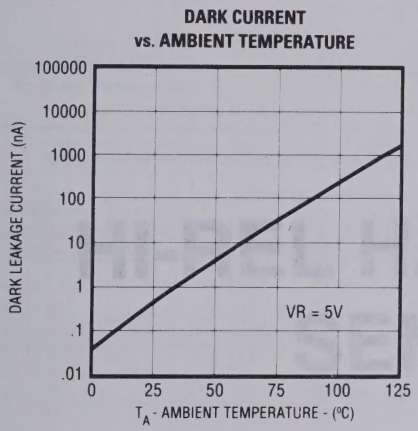
**Notes:**
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ $V_R$ = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.

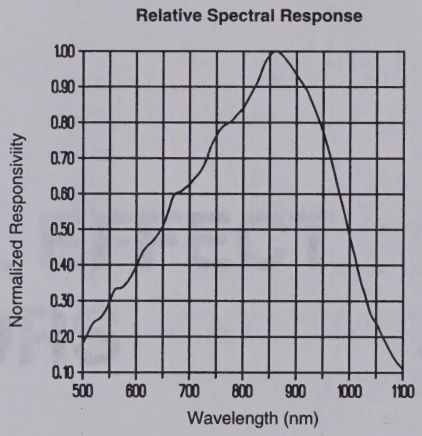
# Type OMF432TX, OMF432TXV

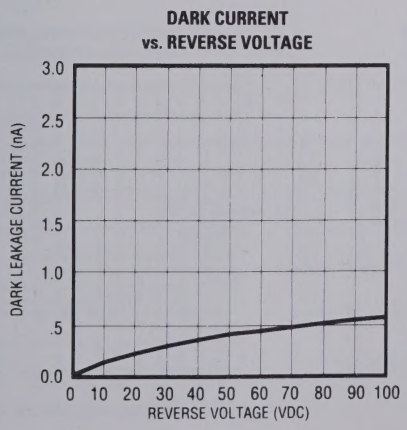
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

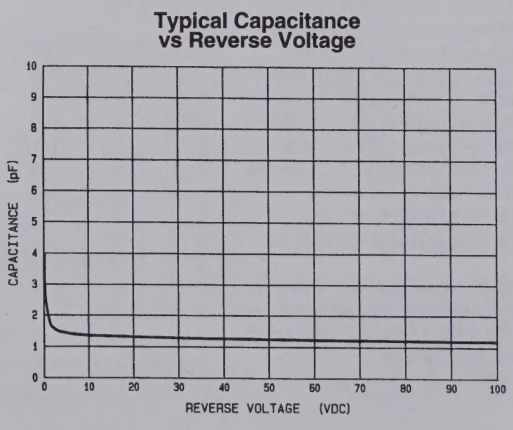
| Symbol | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| R | Flux Responsivity | 0.45 | 0.55 | | A/W | $V_R$ = 5.0V[3] |
| $I_D$ | Dark Current | | 0.1 | 5.0 | nA | $V_R$ = 5.0V |
| λp | Peak Response Wavelength | | 860 | | nm | |
| $t_r$ | Output Rise Time | | 0.6 | | ns | $V_R$ = 50.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 1.0 | | ns | $V_R$ = 15.0V, $R_L$ = 50Ω, 10%-90% |
| $t_r$ | Output Rise Time | | 2.0 | | ns | $V_R$ = 5.0V, $R_L$ = 50Ω, 10%-90% |
| $C_T$ | Total Capacitance | | 1.5 | 2.0 | pF | $V_R$ = 5.0V |

**Typical Performance Curves**



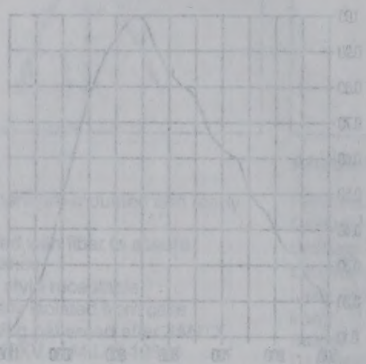



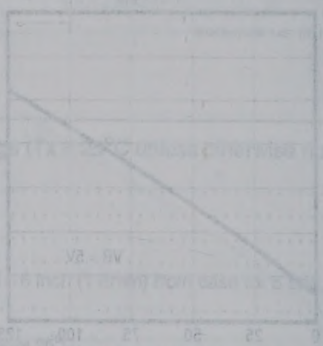



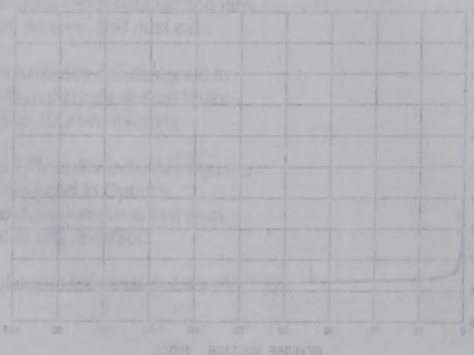


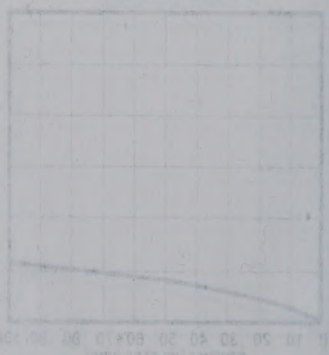

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396





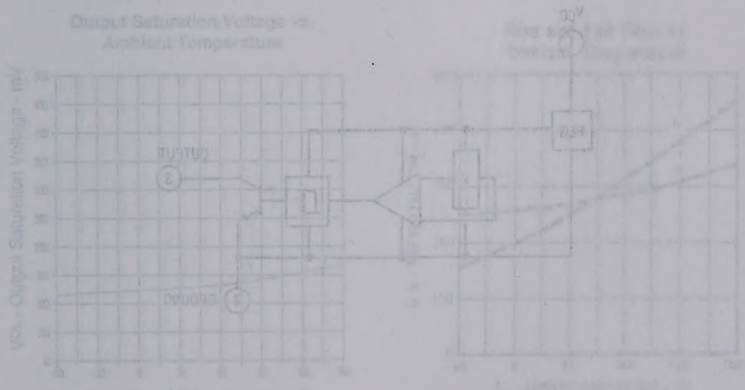




OPTEK TECHNOLOGY, INC.

# HI-REL HALL EFFECT SENSORS

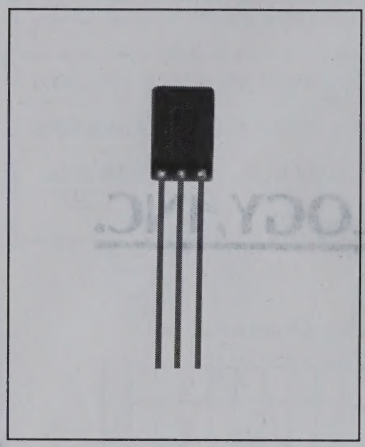


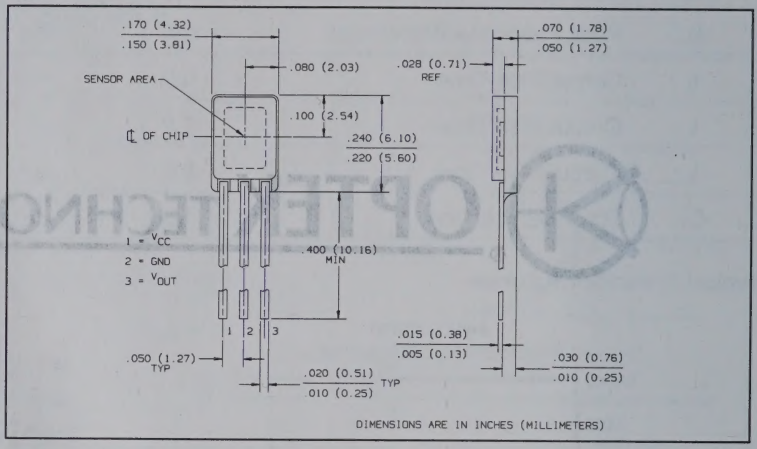


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# High Reliability Hallogic™ Hall Effect Sensor
## Types OMH090B, OMH090S






### Features

- Lead finish is hot solder dip
- Hermetic ceramic package
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip
- Processing patterned after class B or class S of MIL-STD-883
- Suitable for military and space applications

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

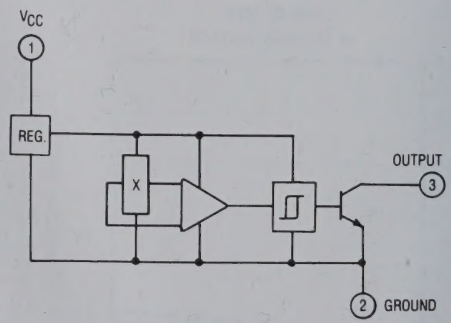
| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ | -55°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

### Description

The chip contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and is capable of 25 mA of sink current. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OMH090B is processed to Optek's own screening procedures patterned after class B of MIL-STD-883. OMH090S is patterned after class S.

### Functional Block Diagram



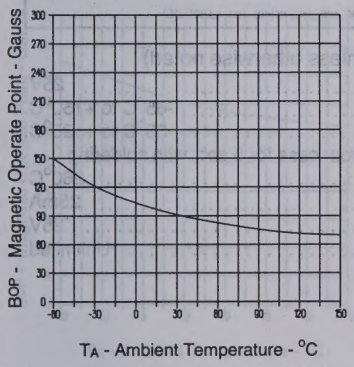
# Types OMH090B, OMH090S

**Electrical Characteristics** ($T_A$ = 25°C, $V_{CC}$ = 4.5V to 24V unless otherwise noted)

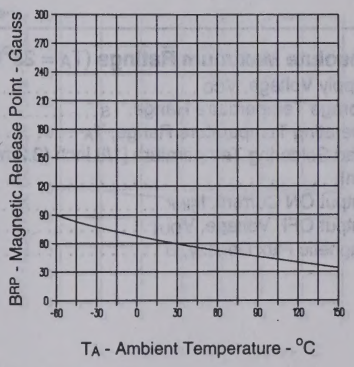
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | 50 | 90 | 180 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | 30 | 60 | 160 | Gauss | |
| $B_H$ | Magnetic Hysteresis | 5 | 30 | 70 | Gauss | |
| $I_{CC}$ | Supply Current | | 5.0 | 9.0 | mA | $V_{CC}$ = 24V, Output On |
| $V_{OL}$ | Output Saturation Voltage | | 125 | 300 | mV | $V_{CC}$ = 4.5V, $I_{OL}$ = 15mA |
| $I_{OH}$ | Output Leakage Current | | 0.50 | 10.0 | µA | $V_{CC}$ = 24V, $V_{OUT}$ = 24V |
| $t_r$ | Output Rise Time | | 0.13 | 1.00 | µs | $R_L$ = 820Ω, $C_L$ = 20pF |
| $t_f$ | Output Fall Time | | 0.19 | 1.00 | µs | $R_L$ = 820Ω, $C_L$ = 20pF |

## Typical Performance Curves

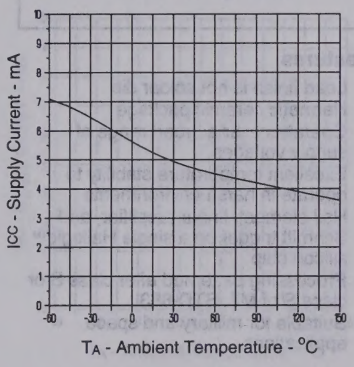
**Magnetic Operate Point vs. Ambient Temperature**



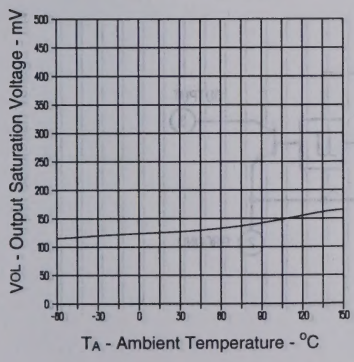

**Magnetic Release Point vs. Ambient Temperature**



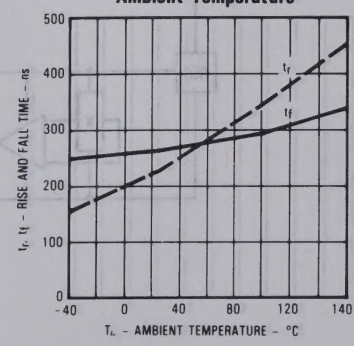

**Supply Current vs. Ambient Temperature**



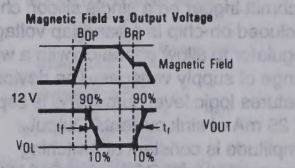

**Output Saturation Voltage vs. Ambient Temperature**



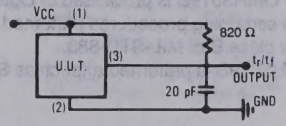

**Rise and Fall Time vs Ambient Temperature**




**Rise and Fall Time Tests**



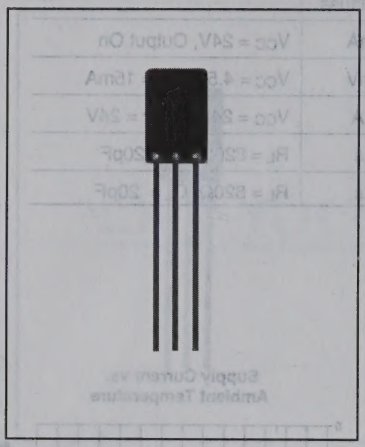

**Rise and Fall Time Test Circuit**

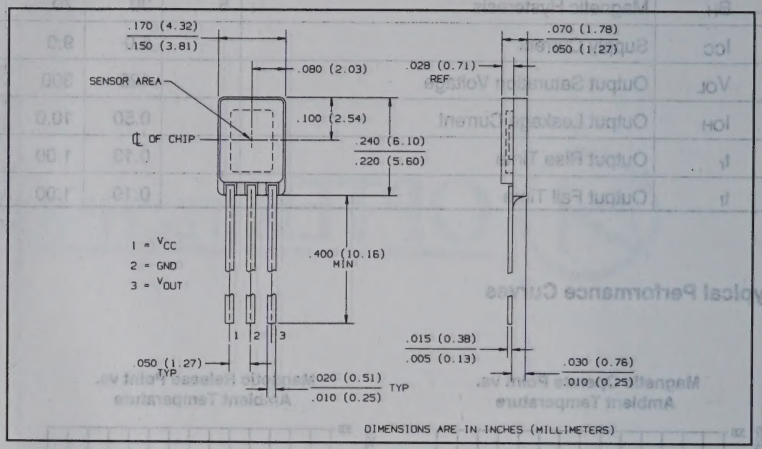



HI REL HALL EFFECT

OPTEK

# High Reliability Hallogic™ Hall Effect Sensor
## Types OMH3019B, OMH3019S






### Features

- Lead finish is hot solder dip
- Hermetic ceramic package
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip
- Processing patterned after class B or class S of MIL-STD-883
- Suitable for military and space applications

### Description

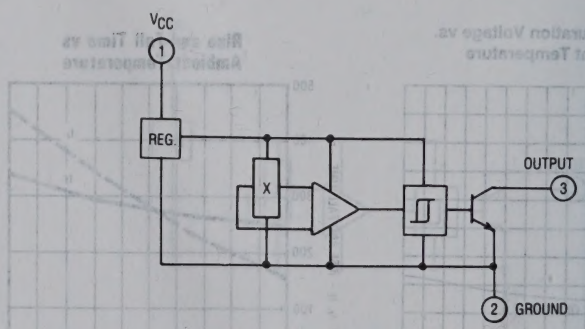
The chip contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and is capable of 25 mA of sink current. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OMH3019B is processed to Optek's own screening procedures patterned after class B of MIL-STD-883. OMH3019S is patterned after class S.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, Ts | -65°C to +150°C |
| Operating Temperature Range, $T_A$ | -55°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

### Functional Block Diagram



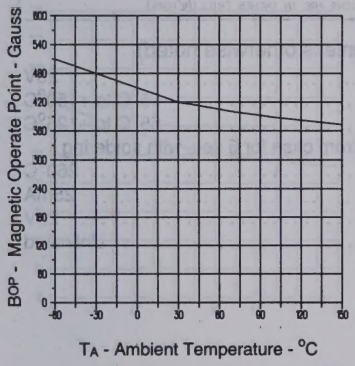
# Types OMH3019B, OMH3019S

**Electrical Characteristics** ($T_A$ = 25°C, $V_{CC}$ = 4.5V to 24VDC unless otherwise noted)

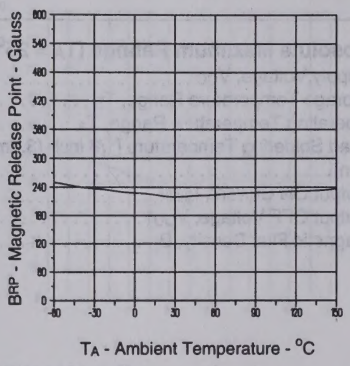
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | 175 | 420 | 500 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | 125 | 220 | 420 | Gauss | |
| $B_H$ | Magnetic Hysteresis | 30 | 100 | 155 | Gauss | |
| $I_{CC}$ | Supply Current | | 5.0 | 9.0 | mA | $V_{CC}$ = 24V, Output On |
| $V_{OL}$ | Output Saturation Voltage | | 125 | 300 | mV | $V_{CC}$ = 4.5V, $I_{OL}$ = 15mA |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 24V, $V_{OUT}$ = 24V |
| $t_r$ | Output Rise Time | | 0.13 | 1.00 | µs | $R_L$ = 820Ω, $C_L$ = 20pF |
| $t_f$ | Output Fall Time | | 0.19 | 1.00 | µs | $R_L$ = 820Ω, $C_L$ = 20pF |

## Typical Performance Curves

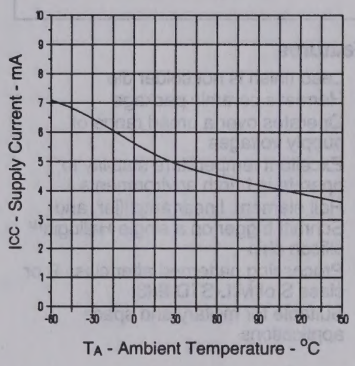
**Magnetic Operate Point vs. Ambient Temperature**



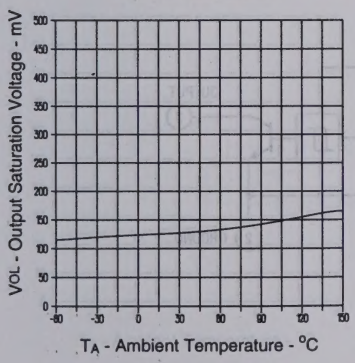

**Magnetic Release Point vs. Ambient Temperature**



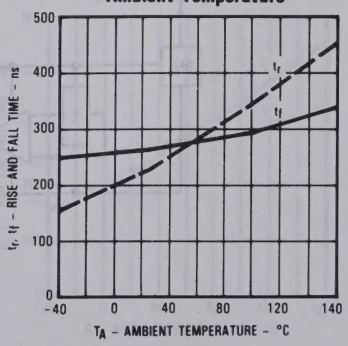

**Supply Current vs. Ambient Temperature**



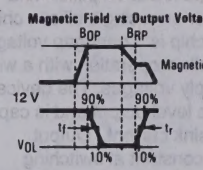

**Output Saturation Voltage vs. Ambient Temperature**



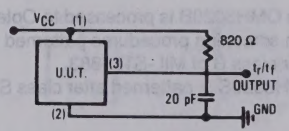

**Rise and Fall Time vs Ambient Temperature**




**Rise and Fall Time Tests**

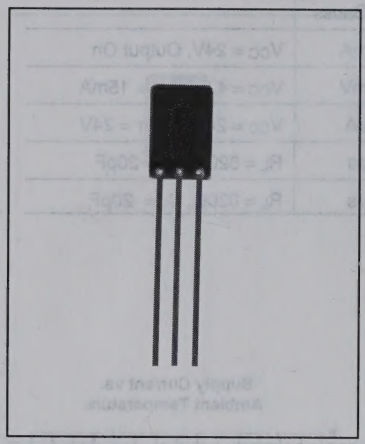


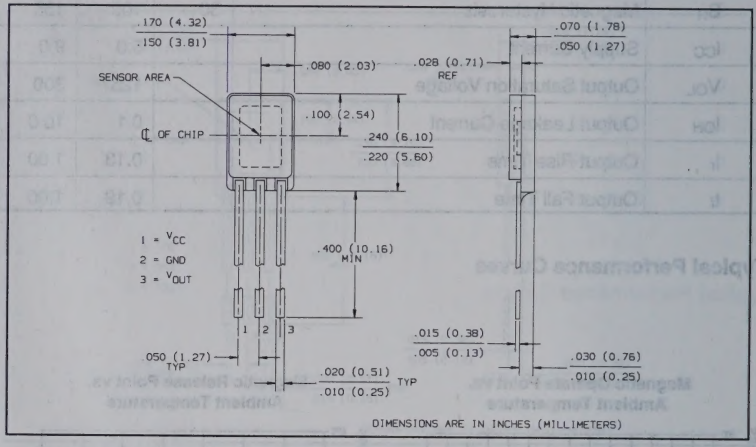

**Rise and Fall Time Test Circuit**




HI REL HALL EFFECT

# High Reliability Hallogic™ Hall Effect Sensor
## Types OMH3020B, OMH3020S






### Features

- Lead finish is hot solder dip
- Hermetic ceramic package
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip
- Processing patterned after class B or class S of MIL-STD-883
- Suitable for military and space applications

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

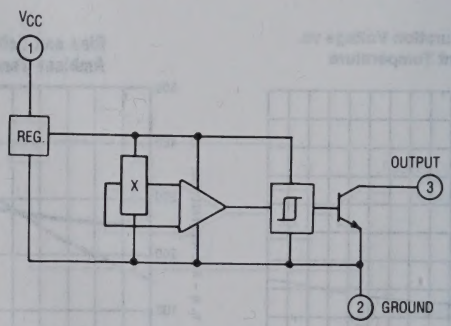
| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ | -55°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

### Description

The chip contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and is capable of 25 mA of sink current. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OMH3020B is processed to Optek's own screening procedures patterned after class B of MIL-STD-883. OMH3020S is patterned after class S.

### Functional Block Diagram



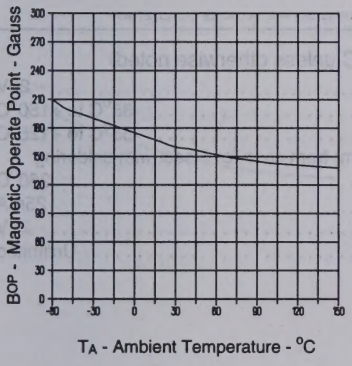
# Types OMH3020B, OMH3020S

**Electrical Characteristics** ($V_{CC}$ = 4.5V to 24VDC, $T_A$ = 25°C unless otherwise noted)

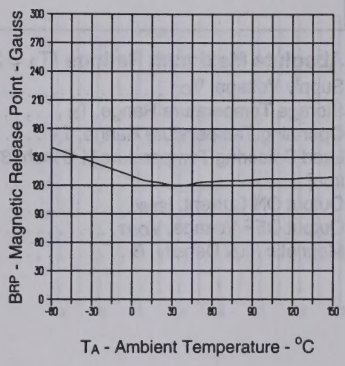
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | 70 | 220 | 350 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | 50 | 165 | 330 | Gauss | |
| $B_H$ | Magnetic Hysteresis | 15 | 55 | 200 | Gauss | |
| $I_{CC}$ | Supply Current | | 5.0 | 9.0 | mA | $V_{CC}$ = 24V, Output On |
| $V_{OL}$ | Output Saturation Voltage | | 125 | 300 | mV | $V_{CC}$ = 4.5V, $I_{OL}$ = 15mA |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 24V, $V_{OUT}$ = 24V |
| $t_r$ | Output Rise Time | | 0.13 | 1.00 | µs | $R_L$ = 820Ω, $C_L$ = 20pF |
| $t_f$ | Output Fall Time | | 0.19 | 1.00 | µs | $R_L$ = 820Ω, $C_L$ = 20pF |

## Typical Performance Curves

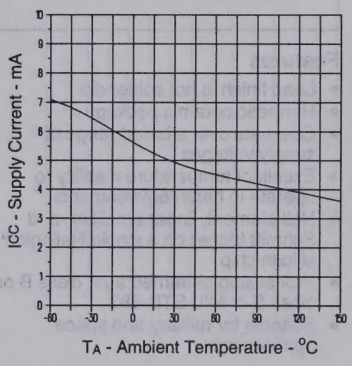
**Magnetic Operate Point vs. Ambient Temperature**



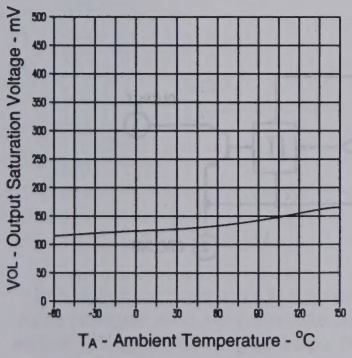

**Magnetic Release Point vs. Ambient Temperature**



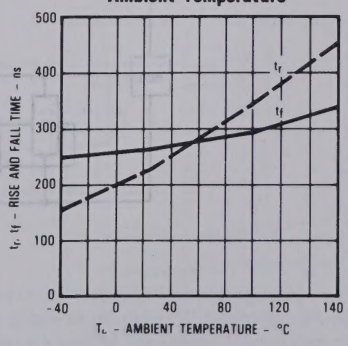

**Supply Current vs. Ambient Temperature**



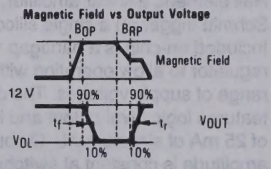

**Output Saturation Voltage vs. Ambient Temperature**



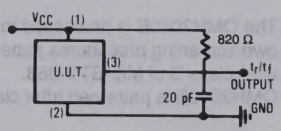

**Rise and Fall Time vs Ambient Temperature**




**Rise and Fall Time Tests**




**Rise and Fall Time Test Circuit**



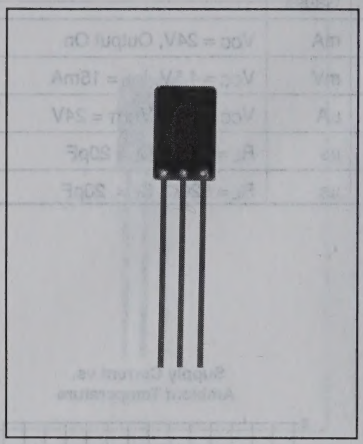

HI REL HALL EFFECT

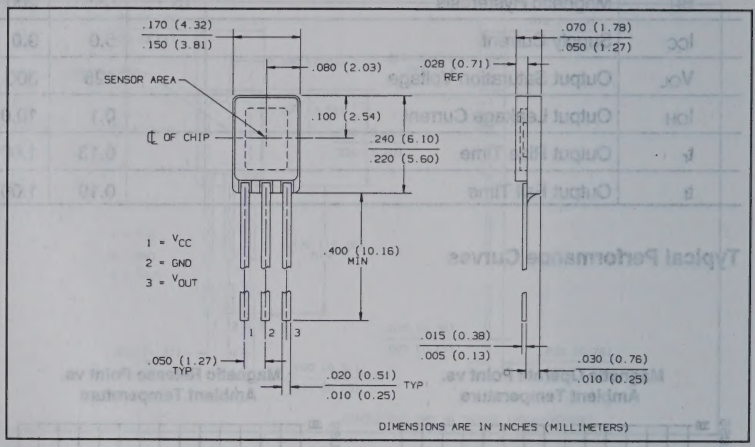
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# High Reliability Hallogic™ Hall Effect Sensor
## Types OMH3040B, OMH3040S






### Features

- Lead finish is hot solder dip
- Hermetic ceramic package
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip
- Processing patterned after class B or class S of MIL-STD-883
- Suitable for military and space applications

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

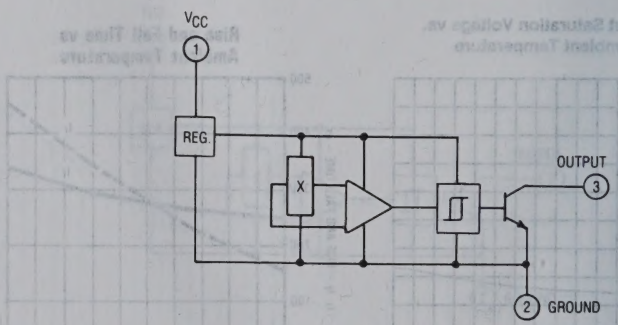
| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ | -55°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

### Description

The chip contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and is capable of 25 mA of sink current. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OMH3040B is processed to Optek's own screening procedures patterned after class B of MIL-STD-883. OMH3040S is patterned after class S.

### Functional Block Diagram



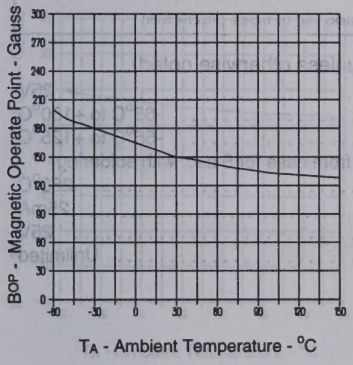
# Types OMH3040B, OMH3040S

**Electrical Characteristics** ($V_{CC}$ = 4.5V to 24V, $T_A$ = 25°C unless otherwise noted)

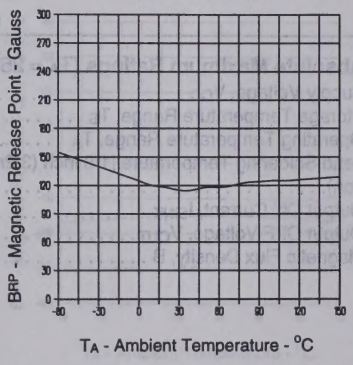
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | 70 | 150 | 200 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | 50 | 115 | 180 | Gauss | |
| $B_H$ | Magnetic Hysteresis | 10 | 35 | 60 | Gauss | |
| $I_{CC}$ | Supply Current | | 5.0 | 9.0 | mA | $V_{CC}$ = 24V, Output On |
| $V_{OL}$ | Output Saturation Voltage | | 125 | 300 | mV | $V_{CC}$ = 4.5V, $I_{OL}$ = 15mA |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 24V, $V_{OUT}$ = 24V |
| $t_r$ | Output Rise Time | | 0.13 | 1.00 | µs | $R_L$ = 820Ω, $C_L$ = 20pF |
| $t_f$ | Output Fall Time | | 0.19 | 1.00 | µs | $R_L$ = 820Ω, $C_L$ = 20pF |

## Typical Performance Curves

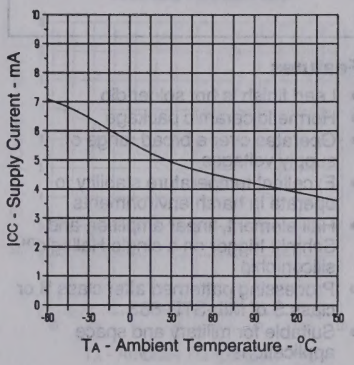
**Magnetic Operate Point vs. Ambient Temperature**



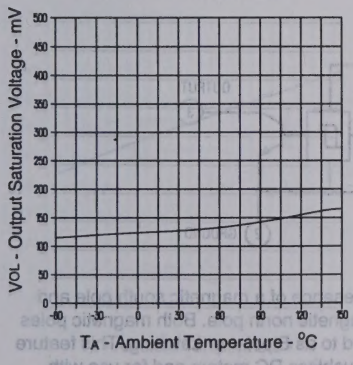

**Magnetic Release Point vs. Ambient Temperature**



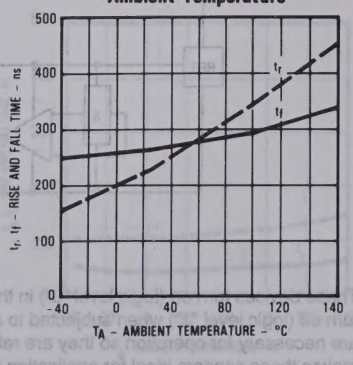

**Supply Current vs. Ambient Temperature**



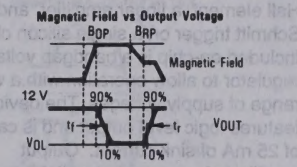

**Output Saturation Voltage vs. Ambient Temperature**



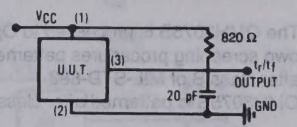

**Rise and Fall Time vs Ambient Temperature**




**Rise and Fall Time Tests**




**Rise and Fall Time Test Circuit**

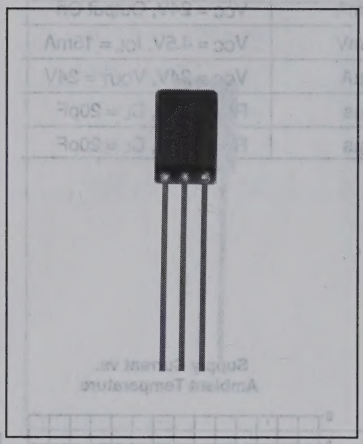


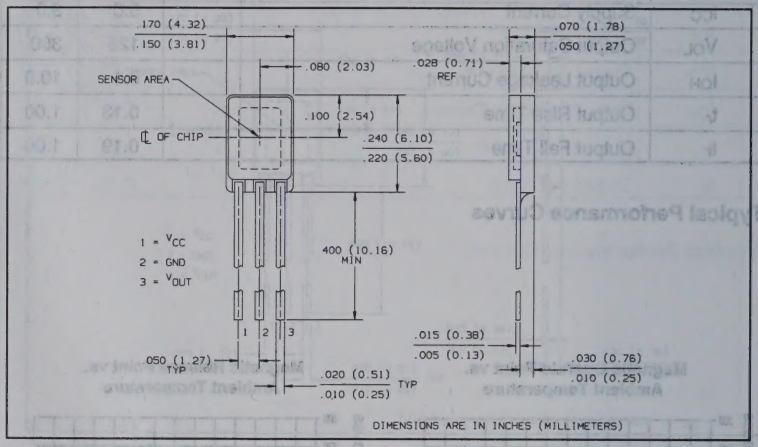



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# High Reliability Hallogic™ Hall Effect Sensor
## Types OMH3075B, OMH3075S (Bi-Polar Latching)






### Features

- Lead finish is hot solder dip
- Hermetic ceramic package
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip
- Processing patterned after class B or class S of MIL-STD-883
- Suitable for military and space applications

### Description

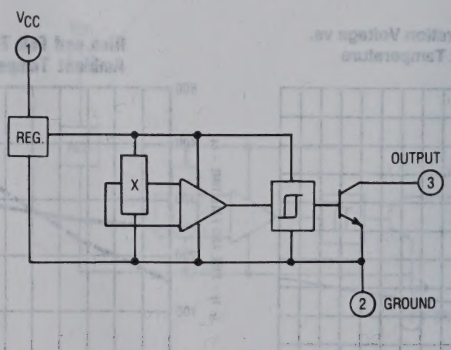
The chip contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and is capable of 25 mA of sink current. Output amplitude is constant at switching frequencies from DC to over 100 kHz.

The OMH3075B is processed to Optek's own screening procedures patterned after class B of MIL-STD-883. OMH3075S is patterned after class S.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ | -55°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

### Functional Block Diagram




These devices turn on (logic level "0") in the presence of a magnetic south pole and turn off (logic level "1") when subjected to a magnetic north pole. Both magnetic poles are necessary for operation so they are referred to as Bipolar or Latching. This feature makes these sensors ideal for application in brushless DC motors and for use with multiple pole magnets.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

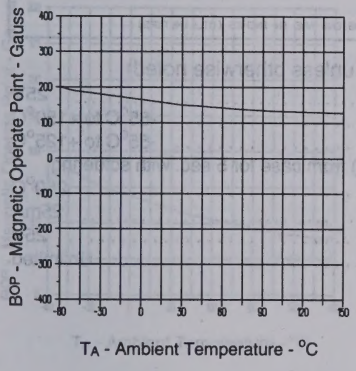
# Types OMH3075B, OMH3075S

**Electrical Characteristics** ($V_{CC}$ = 4.5V to 24V, $T_A$ = 25°C unless otherwise noted)

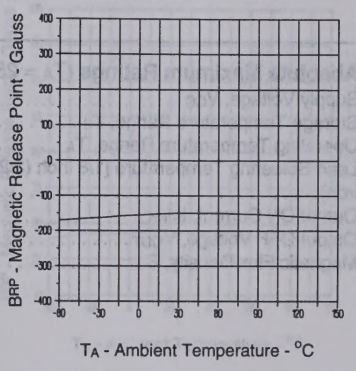
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | 50 | 150 | 250 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | -250 | -150 | -50 | Gauss | |
| $B_H$ | Magnetic Hysteresis | 100 | 300 | 500 | Gauss | |
| $I_{CC}$ | Supply Current | | 5.0 | 9.0 | mA | $V_{CC}$ = 24V, Output On |
| $V_{OL}$ | Output Saturation Voltage | | 190 | 400 | mV | $V_{CC}$ = 4.5V, $I_{OL}$ = 15mA |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 24V, $V_{OUT}$ = 24V |
| $t_r$ | Output Rise Time | | 0.13 | 1.00 | µs | $R_L$ = 820Ω, $C_L$ = 20pF |
| $t_f$ | Output Fall Time | | 0.19 | 1.00 | µs | $R_L$ = 820Ω, $C_L$ = 20pF |

## Typical Performance Curves

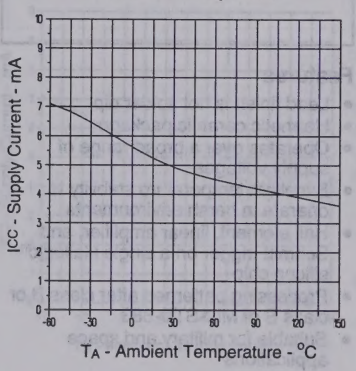
**Magnetic Operate Point vs. Ambient Temperature**



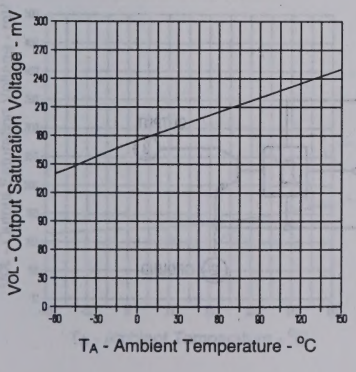

**Magnetic Release Point vs. Ambient Temperature**



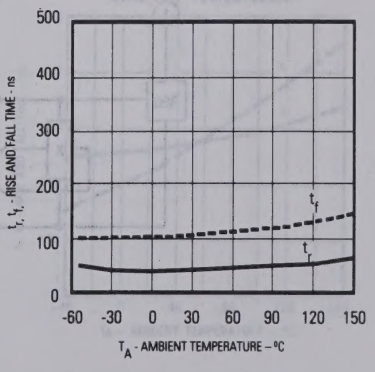

**Supply Current vs. Ambient Temperature**



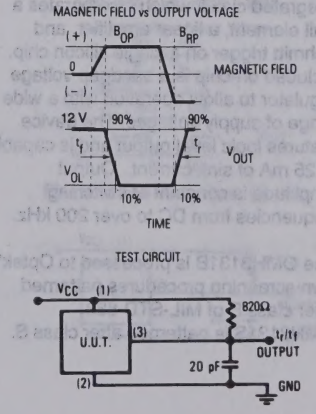

**Output Saturation Voltage vs. Ambient Temperature**




**RISE AND FALL TIME vs AMBIENT TEMPERATURE**




**RISE AND FALL TIME TEST**



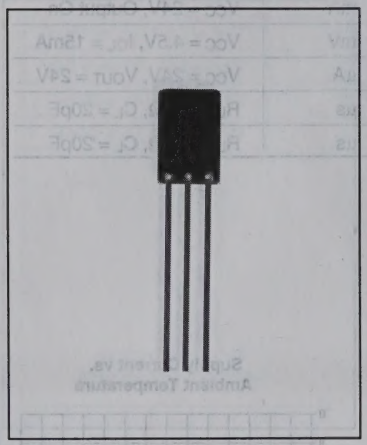

HI REL HALL EFFECT

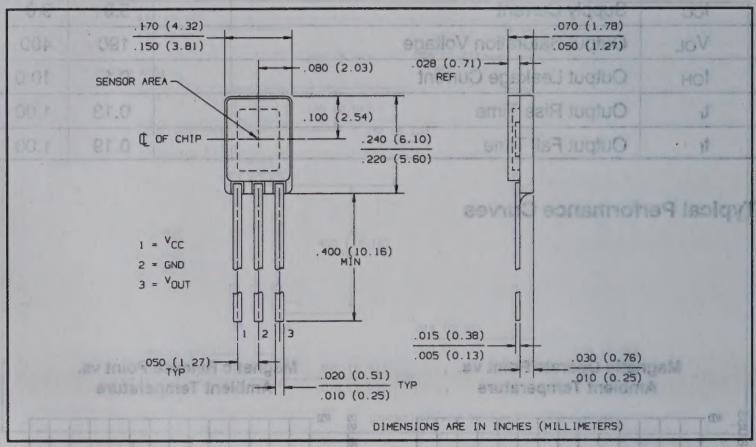
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# High Reliability Ultra Sensitive Hallogic™ Sensor
## Types OMH3131B, OMH3131S






### Features

- Lead finish is hot solder dip
- Hermetic ceramic package
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip
- Processing patterned after class B or class S of MIL-STD-883
- Suitable for military and space applications

### Description

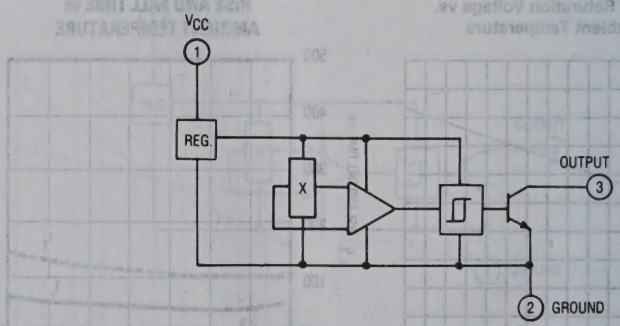
The chip contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and is capable of 25 mA of sink current. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OMH3131B is processed to Optek's own screening procedures patterned after class B of MIL-STD-883. OMH3131S is patterned after class S.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ | -55°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

### Functional Block Diagram



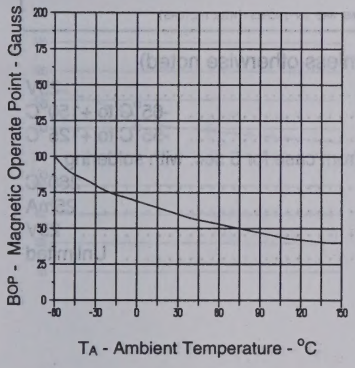
# Types OMH3131B, OMH3131S

**Electrical Characteristics** ($V_{CC}$ = 4.5V to 24V, $T_A$ = 25°C unless otherwise noted)

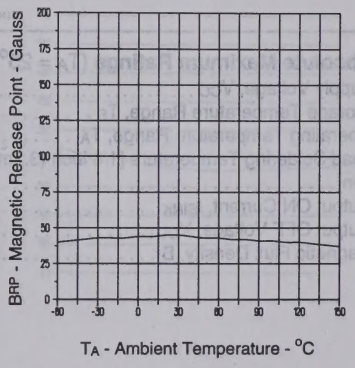
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | 20 | 60 | 95 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | 10 | 45 | 85 | Gauss | |
| $B_H$ | Magnetic Hysteresis | 5 | 15 | 40 | Gauss | |
| $I_{CC}$ | Supply Current | | 5.0 | 9.0 | mA | $V_{CC}$ = 24V, Output On |
| $V_{OL}$ | Output Saturation Voltage | | 125 | 300 | mV | $V_{CC}$ = 4.5V, $I_{OL}$ = 15mA |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 24V, $V_{OUT}$ = 24V |
| $t_r$ | Output Rise Time | | 0.13 | 1.00 | µs | $R_L$ = 820Ω, $C_L$ = 20pF |
| $t_f$ | Output Fall Time | | 0.19 | 1.00 | µs | $R_L$ = 820Ω, $C_L$ = 20pF |

## Typical Performance Curves

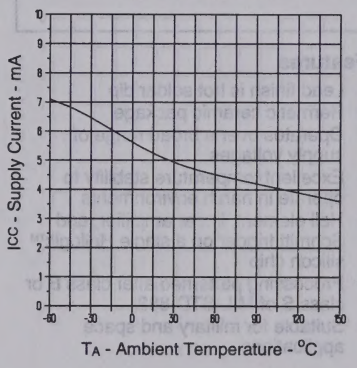
**Magnetic Operate Point vs. Ambient Temperature**



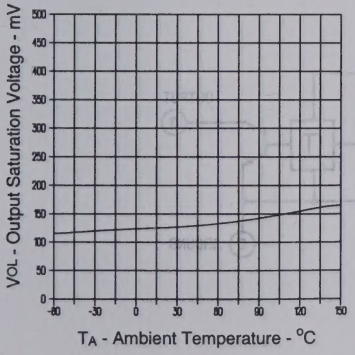

**Magnetic Release Point vs. Ambient Temperature**



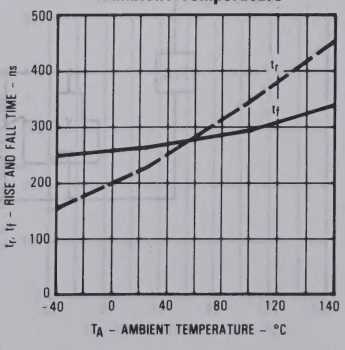

**Supply Current vs. Ambient Temperature**



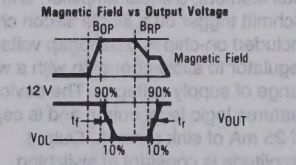

**Output Saturation Voltage vs. Ambient Temperature**



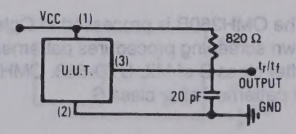

**Rise and Fall Time vs Ambient Temperature**




**Rise and Fall Time Tests**




**Rise and Fall Time Test Circuit**

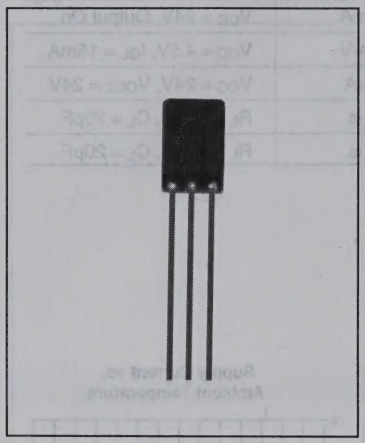


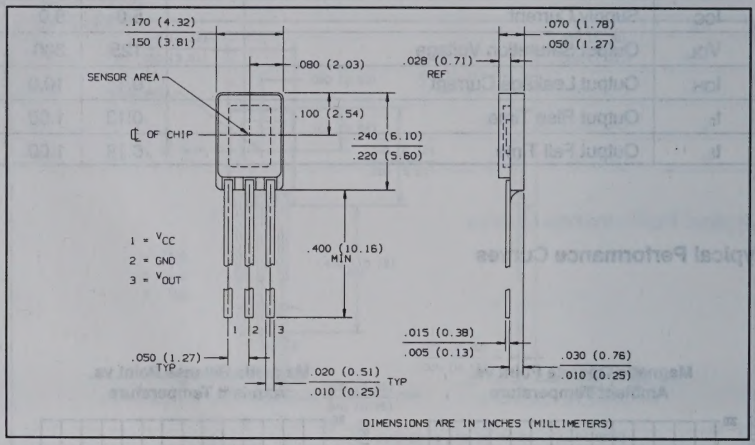

HI REL HALL EFFECT

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# High Reliability Hallogic™ Hall Effect Sensor
## Types OMH360B, OMH360S






### Features

- Lead finish is hot solder dip
- Hermetic ceramic package
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip
- Processing patterned after class B or class S of MIL-STD-883
- Suitable for military and space applications

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

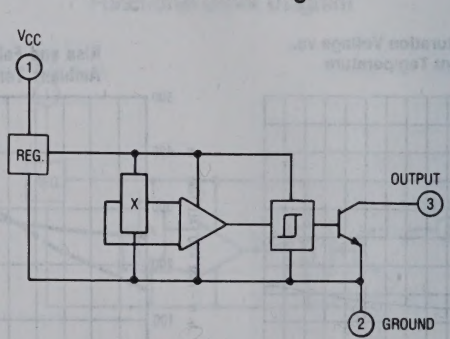
| | |
|---|---|
| Supply Voltage, $V_{CC}$ | 25V |
| Storage Temperature Range, $T_S$ | -65°C to +150°C |
| Operating Temperature Range, $T_A$ | -55°C to +125°C |
| Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] | 260°C |
| Output ON Current, $I_{SINK}$ | 25mA |
| Output OFF Voltage, $V_{OUT}$ | 25V |
| Magnetic Flux Density, B | Unlimited |

### Description

The chip contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and is capable of 25 mA of sink current. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OMH360B is processed to Optek's own screening procedures patterned after class B of MIL-STD-883. OMH360S is patterned after class S.

### Functional Block Diagram



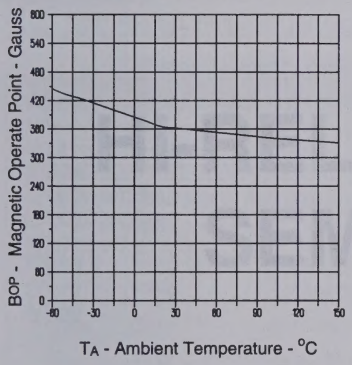
# Types OMH360B, OMH360S

**Electrical Characteristics** ($T_A$ = 25°C, $V_{CC}$ = 4.5V to 24V unless otherwise noted)

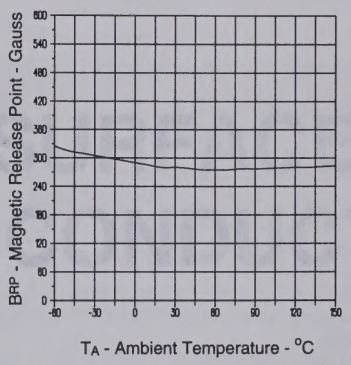
| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $B_{OP}$ | Magnetic Operate Point | 235 | 360 | 465 | Gauss | |
| $B_{RP}$ | Magnetic Release Point | 170 | 280 | 360 | Gauss | |
| $B_H$ | Magnetic Hysteresis | 30 | 80 | 150 | Gauss | |
| $I_{CC}$ | Supply Current | | 5.0 | 9.0 | mA | $V_{CC}$ = 24V, Output On |
| $V_{OL}$ | Output Saturation Voltage | | 125 | 300 | mV | $V_{CC}$ = 4.5V, $I_{OL}$ = 15mA |
| $I_{OH}$ | Output Leakage Current | | 0.1 | 10.0 | µA | $V_{CC}$ = 24V, $V_{OUT}$ = 24V |
| $t_r$ | Output Rise Time | | 0.13 | 1.00 | µs | $R_L$ = 820Ω, $C_L$ = 20pF |
| $t_f$ | Output Fall Time | | 0.19 | 1.00 | µs | $R_L$ = 820Ω, $C_L$ = 20pF |

## Typical Performance Curves

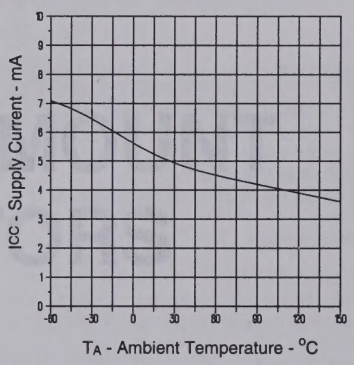
**Magnetic Operate Point vs. Ambient Temperature**



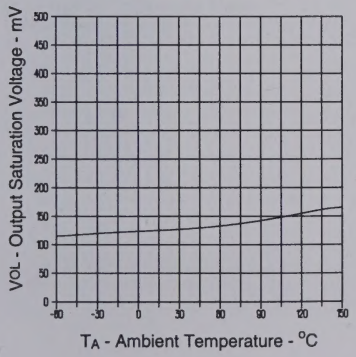

**Magnetic Release Point vs. Ambient Temperature**



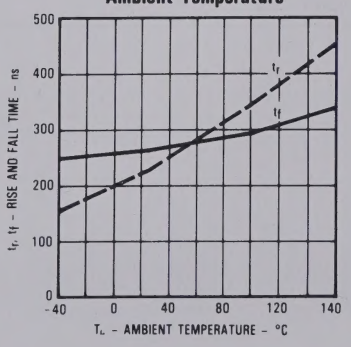

**Supply Current vs. Ambient Temperature**



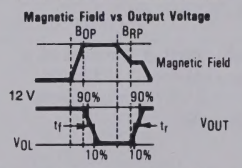

**Output Saturation Voltage vs. Ambient Temperature**



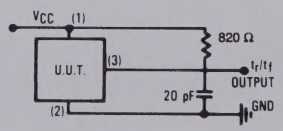

**Rise and Fall Time vs Ambient Temperature**



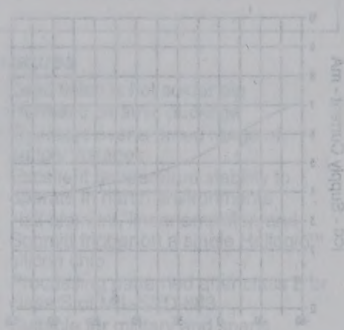

**Rise and Fall Time Tests**

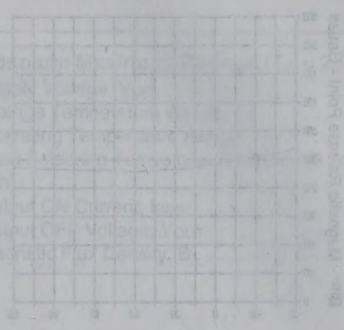


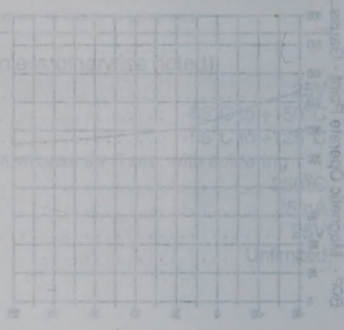

**Rise and Fall Time Test Circuit**

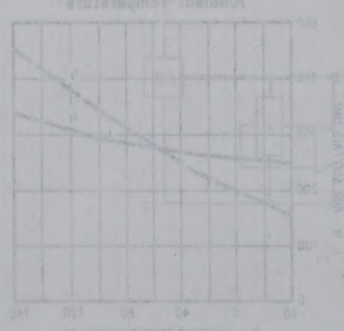


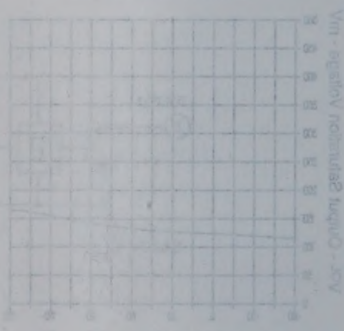

HI REL HALL EFFECT

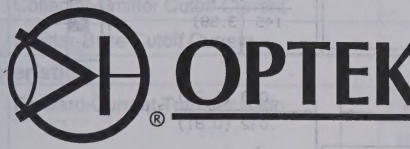












OPTEK TECHNOLOGY, INC.

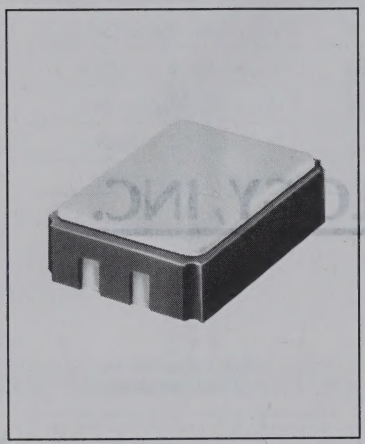
# HI-REL SURFACE MOUNT SEMICONDUCTORS

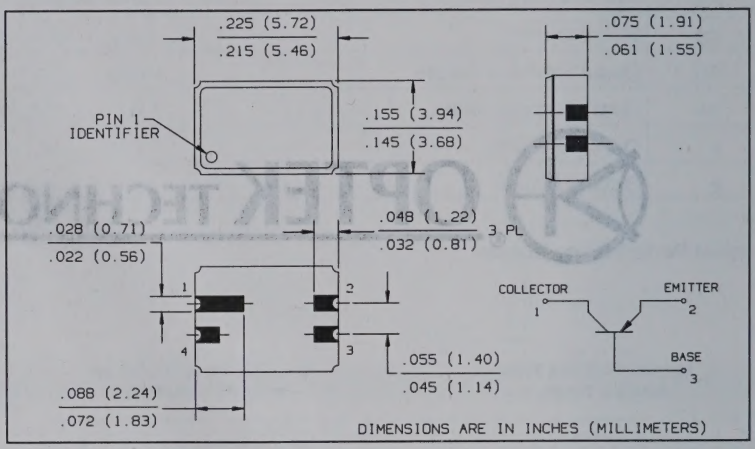


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Surface Mount PNP General Purpose Transistor
## Type JANTX, JANTXV-2N2907AUA






### Features

- Ceramic surface mount package
- Miniature package to minimize circuit board area
- Hermetically sealed
- Qualification per MIL-S-19500/291

### Description

The JANTX/TXV2N2907AUA is a hermetically sealed ceramic surface mount general purpose switching transistor. The miniature four pin ceramic package is ideal for designs where board space and device weight are important design considerations. The "UA" suffix denotes the 4 terminal leadless chip carrier package, type "A" per MIL-S-19500/291.

This data sheet is provided as a summary reference. Refer to MIL-S-19500/291 for complete requirements.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Base voltage | 60V |
| Collector-Emitter Voltage | 60V |
| Emitter-Base Voltage | 5.0V |
| Collector Current-Continuous | 600mA |
| Operating Junction Temperature ($T_J$) | -65°C to +200°C |
| Storage Junction Temperature ($T_{stg}$) | -65°C to +200°C |
| Power Dissipation @ $T_A$ = 25°C | 0.4W |
| Power Dissipation @ $T_C$ = 25°C | 1.16W(1) |
| Soldering Temperature (vapor phase reflow for 30 sec.) | 215°C |
| Soldering Temperature (heated collet for 5 sec.) | 260°C |

**Notes:**
(1) Derate linearly 6.6mW/°C above 25°C.

# Types JANTX, JANTXV-2N2907AUA

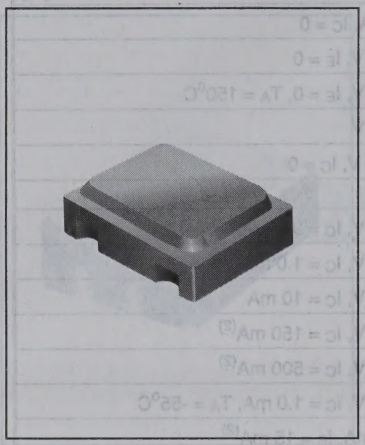
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

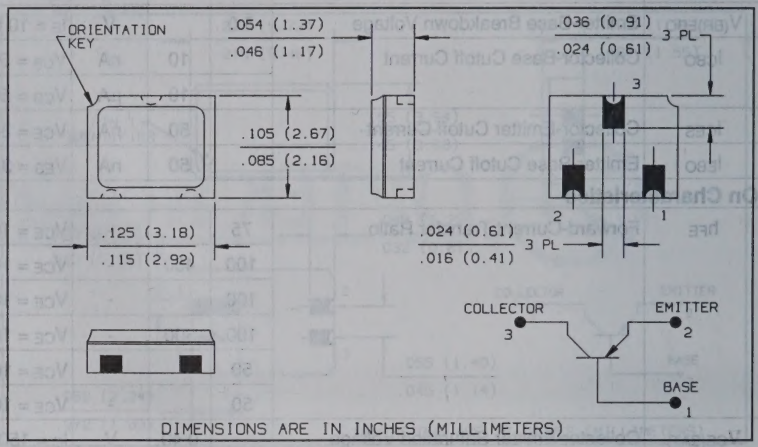
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Off Characteristics** | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 60 | | V | $I_C$ = 10 µA, $I_E$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 60 | | V | $I_C$ = 10 mA, $I_B$ = 0(2) |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | 5.0 | | V | $I_E$ = 10 µA, $I_C$ = 0 |
| $I_{CBO}$ | Collector-Base Cutoff Current | | 10 | nA | $V_{CB}$ = 50 V, $I_E$ = 0 |
| | | | 10 | µA | $V_{CB}$ = 50 V, $I_E$ = 0, $T_A$ = 150°C |
| $I_{CES}$ | Collector-Emitter Cutoff Current | | 50 | nA | $V_{CE}$ = 30 V |
| $I_{EBO}$ | Emitter-Base Cutoff Current | | 50 | nA | $V_{EB}$ = 3.5 V, $I_C$ = 0 |
| **On Characteristics** | | | | | |
| $h_{FE}$ | Forward-Current Transfer Ratio | 75 | | - | $V_{CE}$ = 10 V, $I_C$ = 0.1 mA |
| | | 100 | 450 | - | $V_{CE}$ = 10 V, $I_C$ = 1.0 mA |
| | | 100 | | - | $V_{CE}$ = 10 V, $I_C$ = 10 mA |
| | | 100 | 300 | - | $V_{CE}$ = 10 V, $I_C$ = 150 mA(2) |
| | | 50 | | - | $V_{CE}$ = 10 V, $I_C$ = 500 mA(2) |
| | | 50 | | - | $V_{CE}$ = 10 V, $I_C$ = 1.0 mA, $T_A$ = -55°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.40 | V | $I_C$ = 150 mA, $I_B$ = 15 mA(2) |
| | | | 1.60 | V | $I_C$ = 500 mA, $I_B$ = 50 mA(2) |
| $V_{BE(SAT)}$ | Base-Emitter Saturation Voltage | | 1.30 | V | $I_C$ = 150 mA, $I_B$ = 15 mA(2) |
| | | | 2.60 | V | $I_C$ = 500 mA, $I_B$ = 50 mA(2) |
| **Small-Signal Characteristics** | | | | | |
| $h_{fe}$ | Small Signal Forward Current Transfer Ratio | 100 | | - | $V_{CE}$ = 10 V, $I_C$ = 1.0 mA, f = 1.0 kHz |
| $\|h_{fe}\|$ | Small Signal Forward Current Transfer Ratio | 2.0 | | - | $V_{CE}$ = 20 V, $I_C$ = 50 mA, f = 100 MHz |
| $C_{obo}$ | Open Circuit Output Capacitance | | 8.0 | pF | $V_{CB}$ = 10 V, 100 kHz ≤ f ≤ 1.0 MHz |
| $C_{ibo}$ | Input Capacitance (Output Open Capacitance) | | 30 | pF | $V_{EB}$ = 2.0 V, 100 kHz ≤ f ≤ 1.0 MHz |
| **Switching Characteristics** | | | | | |
| $t_{on}$ | Turn-On Time | | 45 | ns | $V_{CC}$ = 30 V, $I_C$ = 150 mA, $I_{B1}$ = 15 mA |
| $t_{off}$ | Turn-Off Time | | 300 | ns | $V_{CC}$ = 30 V, $I_C$ = 150 mA, $I_{B1}$ = $I_{B2}$ = 15 mA |

(2) Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%

HI REL SURFACE MOUNT

# Surface Mount PNP General Purpose Transistor
## Type JANTX, JANTXV-2N2907AUB






### Features

- Ceramic surface mount package
- Miniature package to minimize circuit board area
- Hermetically sealed
- Footprint and pin-out matches SOT-23 packaged transistors
- Qualification per MIL-S-19500/291

### Description

The JANTX/TXV2N2907AUB is a miniature, hermetically sealed, ceramic surface mount general purpose switching transistor. The miniature three pin ceramic package is ideal for upgrading commercial grade circuits to military reliability levels where plastic SOT-23 devices have been used. The "UB" suffix denotes the 3 terminal chip carrier package, type "B" per MIL-S-19500/291.

This data sheet is provided as a summary reference. Refer to MIL-S-19500/291 for complete requirements.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Base Voltage | 60V |
| Collector-Emitter Voltage | 60V |
| Emitter-Base Voltage | 5.0V |
| Collector Current-Continuous | 600mA |
| Operating Junction Temperature ($T_J$) | -65°C to +200°C |
| Storage Junction Temperature ($T_{stg}$) | -65°C to +200°C |
| Power Dissipation @ $T_A$ = 25°C | 0.3W |
| Power Dissipation @ $T_C$ = 25°C | 1.16W(1) |
| Soldering Temperature (vapor phase reflow for 30 sec.) | 215°C |
| Soldering Temperature (heated collet for 5 sec.) | 260°C |

**Notes:**
(1) Derate linearly 6.6mW/°C above 25°C.

# Types JANTX, JANTXV-2N2907AUB

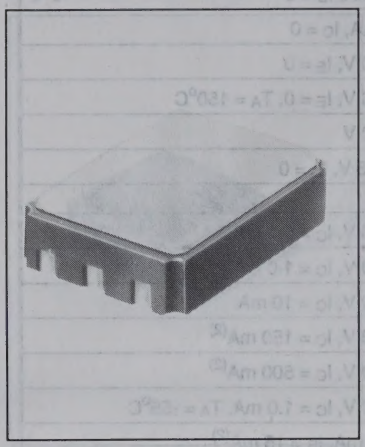
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

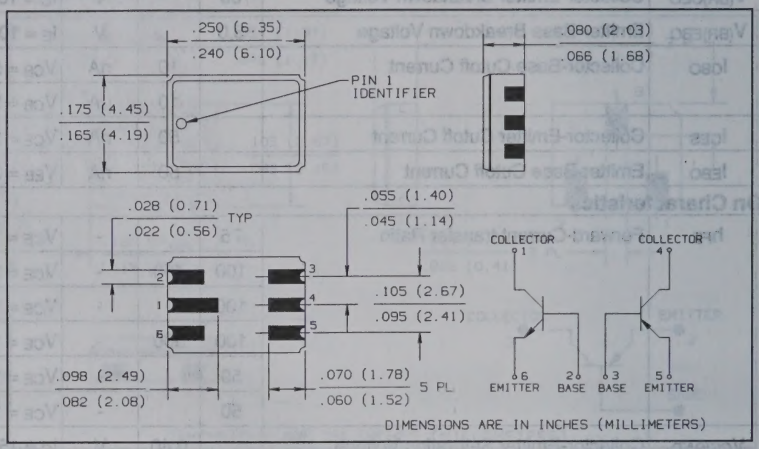
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITION |
|---|---|---|---|---|---|
| **Off Characteristics** | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 60 | | V | $I_C$ = 10 µA, $I_E$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 60 | | V | $I_C$ = 10 mA, $I_B$ = 0[2] |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | 5.0 | | V | $I_E$ = 10 µA, $I_C$ = 0 |
| $I_{CBO}$ | Collector-Base Cutoff Current | | 10 | nA | $V_{CB}$ = 50 V, $I_E$ = 0 |
| | | | 10 | µA | $V_{CB}$ = 50 V, $I_E$ = 0, $T_A$ = 150°C |
| $I_{CES}$ | Collector-Emitter Cutoff Current | | 50 | nA | $V_{CE}$ = 30 V |
| $I_{EBO}$ | Emitter-Base Cutoff Current | | 50 | nA | $V_{EB}$ = 3.5 V, $I_C$ = 0 |
| **On Characteristics** | | | | | |
| $h_{FE}$ | Forward-Current transfer Ratio | 75 | | - | $V_{CE}$ = 10 V, $I_C$ = 0.1 mA |
| | | 100 | 450 | - | $V_{CE}$ = 10 V, $I_C$ = 1.0 mA |
| | | 100 | | - | $V_{CE}$ = 10 V, $I_C$ = 10 mA |
| | | 100 | 300 | - | $V_{CE}$ = 10 V, $I_C$ = 150 mA[2] |
| | | 50 | | - | $V_{CE}$ = 10 V, $I_C$ = 500 mA[2] |
| | | 50 | | - | $V_{CE}$ = 10 V, $I_C$ = 1.0 mA, $T_A$ = -55°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.40 | V | $I_C$ = 150 mA, $I_B$ = 15 mA[2] |
| | | | 1.60 | V | $I_C$ = 500 mA, $I_B$ = 50 mA[2] |
| $V_{BE(SAT)}$ | Base-Emitter Saturation Voltage | | 1.30 | V | $I_C$ = 150 mA, $I_B$ = 15 mA[2] |
| | | | 2.60 | V | $I_C$ = 500 mA, $I_B$ = 50 mA[2] |
| **Small-Signal Characteristics** | | | | | |
| $h_{fe}$ | Forward-Current Transfer Ratio | 100 | | - | $V_{CE}$ = 10 V, $I_C$ = 1.0 mA, f = 1.0 kHz |
| $\|h_{fe}\|$ | Forward-Current Transfer Ratio | 2.0 | | - | $V_{CE}$ = 20 V, $I_C$ = 50 mA, f = 100 MHz |
| $C_{obo}$ | Open Circuit Output Capacitance | | 8.0 | pF | $V_{CB}$ = 10 V, 100 kHz ≤ f ≤ 1.0 MHz |
| $C_{ibo}$ | Input Capacitance (Output Open) | | 30 | pF | $V_{EB}$ = 2.0 V, 100 kHz ≤ f ≤ 1.0 MHz |
| **Switching Characteristics** | | | | | |
| $t_{on}$ | Turn-On Time | | 45 | ns | $V_{CC}$ = 30 V, $I_C$ = 150 mA, $I_{B1}$ = 15 mA |
| $t_{off}$ | Turn-Off Time | | 300 | ns | $V_{CC}$ = 30 V, $I_C$ = 150 mA, $I_{B1}$ = $I_{B2}$ = 15 mA |

(2) Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%

HI REL SURFACE MOUNT

# Surface Mount NPN/PNP Complementary Transistors
# Type JANTX, JANTXV-2N4854U






## Features

- Ceramic surface mount package
- Miniature package to minimize circuit board area required
- Hermetically sealed
- Per MIL-S-19500/421

## Description

The JANTX2N4854U is a hermetically sealed, ceramic surface mount, complementary transistor pair. The JANTX2N4854U consists of an NPN transistor die and PNP transistor die. This surface mount package is the most recent addition to MIL-S-19500/421. The "U" designator denotes the 6 terminal (C-6) leadless chip carrier package option. The miniature six pin ceramic package is ideal for designs where board space and device weight are important design considerations. For non JAN versions, the Optek HCT700 can be used as a similar replacement.

This data sheet is provided as a summary reference. Refer to MIL-S-19500/421 for complete requirements.

## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| NPN to PNP Isolation Voltage | 500VDC |
| Collector-Base Voltage | 60V |
| Collector-Emitter Voltage | 40V |
| Emitter-Base Voltage | 5.0V |
| Collector Current-Continuous | 600mA |
| Operating Junction Temperature ($T_J$) | -65°C to +200°C |
| Storage Junction Temperature ($T_{stg}$) | -65°C to +200°C |
| Power Dissipation @ $T_A$ = 25°C (both transistors driven equally) | 0.6W |
| Power Dissipation @ $T_C$ = 25°C (both transistors driven equally) | 2.0W(1) |
| Soldering Temperature (vapor phase reflow for 30 sec.) | 215°C |
| Soldering Temperature (heated Collet for 5 sec.) | 260°C |

**Notes:**
(1) Derate linearly 11.4mW/°C above 25°C.

# Types JANTX, JANTXV-2N4854U

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted) **See Note 3**

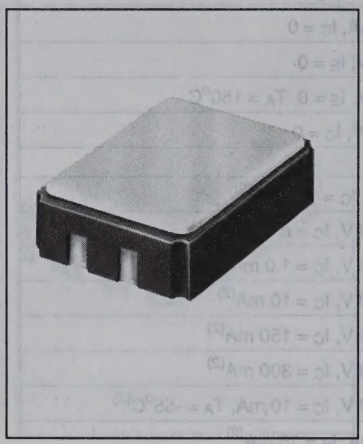
| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|
| **Off Characteristics** | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 60 | | V | $I_C$ = 10.0 µA, $I_E$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 40 | | V | $I_C$ = 10.0 mA, $I_B$ = 0 |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | 5.0 | | V | $I_E$ = 10.0 µA, $I_C$ = 0 |
| $I_{CBO}$ | Collector-Base Cutoff Current | | 10.0 | nA | $V_{CB}$ = 50 V, $I_E$ = 0 |
| | | | 10.0 | µA | $V_{CB}$ = 50 V, $I_E$ = 0, $T_A$ = 150°C |
| $I_{EBO}$ | Emitter-Base Cutoff Current | | 10.0 | nA | $V_{EB}$ = 3.0 V, $I_C$ = 0 |
| **On Characteristics** | | | | | |
| $h_{FE}$ | DC Current Transfer Ratio | 50 | | - | $V_{CE}$ = 1 V, $I_C$ = 150 mA(2) |
| | | 35 | | - | $V_{CE}$ = 10.0 V, $I_C$ = 0.1 mA |
| | | 50 | | - | $V_{CE}$ = 10.0 V, $I_C$ = 1.0 mA |
| | | 75 | | - | $V_{CE}$ = 10.0 V, $I_C$ = 10 mA(2) |
| | | 100 | 300 | - | $V_{CE}$ = 10.0 V, $I_C$ = 150 mA(2) |
| | | 35 | | - | $V_{CE}$ = 10.0 V, $I_C$ = 300 mA(2) |
| | | 12 | | - | $V_{CE}$ = 10.0 V, $I_C$ = 10 mA, $T_A$ = -55°C(2) |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.40 | V | $I_C$ = 150 mA, $I_B$ = 15 mA(2) |
| $V_{BE(SAT)}$ | Base-Emitter Saturation Voltage | 0.8 | | V | $I_C$ = 150 mA, $I_B$ = 15 mA(2) |
| **Small-Signal Characteristics** | | | | | |
| $h_{ie}$ | Small Signal Common Emitter Input Impedance | 1.5 | 9 | kΩ | $V_{CE}$ = 10 V, $I_C$ = 1.0 mA, f = 1.0 kHz |
| $h_{oe}$ | Small Signal Common Emitter Output Admittance | | 50 | µmho | |
| $h_{fe}$ | Small Signal Current Transfer Ratio | 60 | 300 | - | |
| NF | Noise Figure | | 8 | db | f = 1.0 kHz, $R_G$ = 1.0 kΩ, $I_C$ = 0.1 mA, $V_{CE}$ = 10 V |
| $\|h_{fe}\|$ | Small Signal Current Transfer Ratio | 2.0 | 8.0 | - | $V_{CE}$ = 20 V, $I_C$ = 20 mA, f = 100 MHz |
| $C_{obo}$ | Output Capacitance | | 8.0 | pF | $V_{CB}$ = 10 V, 100 kHz ≤ f ≤ 1.0 MHz |
| **Switching Characteristics** | | | | | |
| $t_{on}$ | Turn-On Time | | 45 | ns | $V_{CC}$ = 30 V, $I_C$ = 150 mA, $I_{B1}$ = 15 mA |
| $t_{off}$ | Turn-Off Time | | 300 | ns | $V_{CC}$ = 30 V, $I_C$ = 150 mA, $I_{B1}$ = $I_{B2}$ = 15 mA |

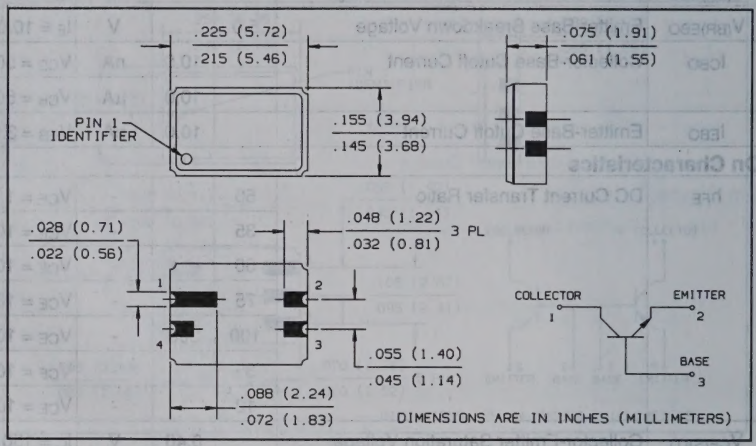
(2) Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%

(3) Polarities given are for the NPN device. Reverse polarity on limits and conditions as applicable for the PNP side.

HI REL SURFACE MOUNT

# Surface Mount NPN General Purpose Transistor
## Type HCT2222A






### Features

- Ceramic surface mount package
- Miniature package to minimize circuit board area
- Electrical performance similar to 2N2222A
- Hermetically sealed package
- Screened per Mil-S-19500 TX or TXV equivalent levels on request

### Description

The HCT2222A is a hermetically sealed ceramic surface-mount general purpose switching transistor, consisting of a 2N2222A silicon NPN transistor die. The HCT2222A electrical characteristics are similar to the MIL-S-19500/255 specification for the JAN2N2222A. The miniature four pin ceramic package is ideal for designs where board space and device weight are important design considerations.

High reliability processing per MIL-S-19500 TX or TXV equivalent levels on request.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Base Voltage | 75V |
| Collector-Emitter Voltage | 50V |
| Emitter-Base Voltage | 6.0V |
| Collector Current-Continuous | 800mA |
| Operating Junction Temperature ($T_J$) | -65°C to +200°C |
| Storage Junction Temperature ($T_{stg}$) | -65°C to +200°C |
| Power Dissipation @ $T_A$ = 25°C | 0.4W |
| Power Dissipation @ $T_S$[(1)] = 25°C | 1.0W[(2)] |
| Soldering Temperature (vapor phase reflow for 30 sec.) | 215°C |
| Soldering Temperature (heated Collet for 5 sec.) | 260°C |

**Notes:**
(1) $T_S$ = Substrate temperature that the chip carrier is mounted on.
(2) Derate linearly 5.7mW/°C above 25°C.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Type HCT2222A

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 75 | | | V | $I_C$ = 10.0 µA, $I_E$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 50 | | | V | $I_C$ = 10.0 mA, $I_B$ = 0 |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | 6.0 | | | V | $I_E$ = 10.0 µA, $I_C$ = 0 |
| $I_{CBO}$ | Collector-Base Cuttoff Current | | | 10.0 | nA | $V_{CB}$ = 60 V, $I_E$ = 0 |
| | | | | 10.0 | µA | $V_{CB}$ = 60 V, $I_E$ = 0, $T_A$ = 150°C |
| $I_{EBO}$ | Emitter-Base Cutoff Current | | | 10.0 | nA | $V_{EB}$ = 4.0 V, $I_C$ = 0 |
| $I_{CES}$ | Collector-Emitter Cutoff Current | | | 1.0 | µA | $V_{CE}$ = 50 V |
| **On Characteristics** | | | | | | |
| $h_{FE}$ | Forward Current Transfer Ratio | 50 | | | - | $V_{CE}$ = 10.0 V, $I_C$ = 0.1 mA |
| | | 75 | | 325 | - | $V_{CE}$ = 10.0 V, $I_C$ = 1.0 mA |
| | | 100 | | | - | $V_{CE}$ = 10.0 V, $I_C$ = 10.0 mA |
| | | 100 | | 300 | - | $V_{CE}$ = 10.0 V, $I_C$ = 150 mA(3) |
| | | 30 | | | - | $V_{CE}$ = 10.0 V, $I_C$ = 500 mA(3) |
| | | 35 | | | - | $V_{CE}$ = 10.0 V, $I_C$ = 10.0 mA, $T_A$ = -55°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | 0.30 | V | $I_C$ = 150 mA, $I_B$ = 15 mA(3) |
| | | | | 1.0 | V | $I_C$ = 500 mA, $I_B$ = 50 mA(3) |
| $V_{BE(SAT)}$ | Base-Emitter Saturation Voltage | 0.60 | | 1.20 | V | $I_C$ = 150 mA, $I_B$ = 15 mA(3) |
| | | | | 2.0 | V | $I_C$ = 500 mA, $I_B$ = 50 mA(3) |
| **Small-Signal Characteristics** | | | | | | |
| $h_{fe}$ | Small-Signal Forward Current Transfer Ratio | 50 | | | - | $V_{CE}$ = 10.0 V, $I_C$ = 1.0 mA, f = 1.0 kHz |
| $\|h_{fe}\|$ | Small-Signal Forward Current Transfer Ratio | 2.5 | | | - | $V_{CE}$ = 20 V, $I_C$ = 20 mA, f = 100 MHz |
| $C_{obo}$ | Open Circuit Output Capacitance | | | 8.0 | pF | $V_{CB}$ = 10.0 V, 100 kHz ≤ f ≤ 1.0 MHz |
| $C_{ibo}$ | Input Capacitance (Output Open Capacitance) | | | 33 | pF | $V_{EB}$ = 0.5 V, 100 kHz ≤ f ≤ 1.0 MHz |
| **Switching Characteristics** | | | | | | |
| $t_{on}$ | Turn-On Time | | | 35 | | $V_{CC}$ = 30 V, $I_C$ = 150 mA, $I_{B1}$ = 15 mA |
| $t_{off}$ | Turn-Off Time | | | 300 | | $V_{CC}$ = 30 V, $I_C$ = 150 mA, $I_{B1}$ = $I_{B2}$ = 15 mA |

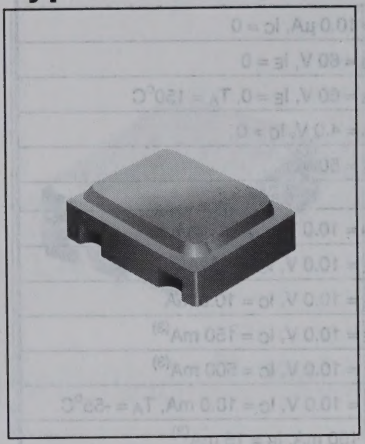
(3) Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%

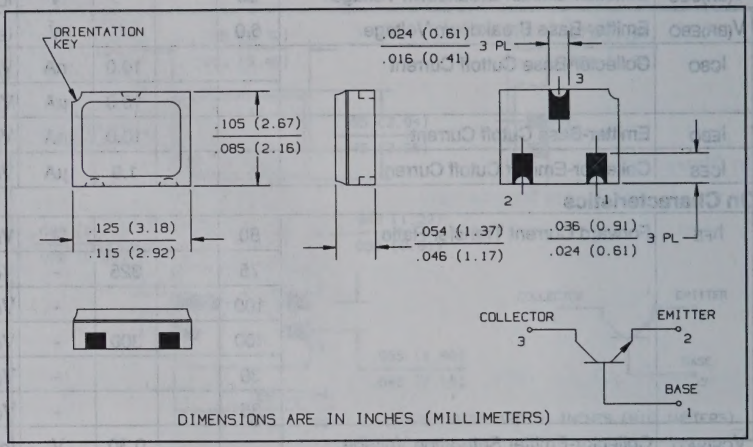
HI REL SURFACE MOUNT

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Surface Mount NPN General Purpose Transistor
## Type HCT2222M






### Feature

- Ceramic surface mount package
- Miniature package to minimize circuit board area
- Electrical performance similar to a JAN2N2222A
- Hermetically sealed package
- Screened per MIL-S-19500 TX or TXV equivalent levels on request
- Same footprint and pin-out as many SOT-23 package transistors

### Description

The HCT2222M is a miniature hermetically sealed ceramic surface-mount general purpose switching transistor, consisting of a 2N2222A silicon NPN transistor die. The HCT2222M electrical characteristics are similar to the MIL-S-19500/255 specification for the JANTX2N2222A. The miniature three pin ceramic package is ideal for upgrading commercial grade circuits to military reliability levels where plastic SOT-23 devices have been used.

High reliability processing available per MIL-S-19500 TX or TXV equivalent levels on request.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Base Voltage | 75V |
| Collector-Emitter Voltage | 50V |
| Emitter-Base Voltage | 6.0V |
| Collector Current-Continuous | 800mA |
| Operating Junction Temperature($T_J$) | -65°C to +200°C |
| Storage Junction Temperature ($T_{stg}$) | -65°C to +200°C |
| Power Dissipation @ $T_A$ = 25°C | 0.3W |
| Power Dissipation @ $T_S$[(1)] = 25°C | 0.75W[(2)] |
| Soldering Temperature (vapor phase reflow for 30 sec.) | 215°C |
| Soldering Temperature (heated collet for 5 sec.) | 260°C |

**Notes**
(1) $T_S$ = Substrate temperature that the chip carrier is mounted on.
(2) Derate linearly 4.2mW/°C above 25°C. This rating is provided as an aid to designers. It is dependent upon mounting material and methods, and is not measureable as an outgoing test.

# Type HCT2222M

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

| Symbol | Parameter | Min. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|
| **Off Characteristics** | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 75 | | V | $I_C = 10.0\mu A$, $I_E = 0$ |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 50 | | V | $I_C = 10.0mA$, $I_B = 0$ |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | 6.0 | | V | $I_E = 10.0\mu A$, $I_C = 0$ |
| $I_{CBO}$ | Collector-Base Cutoff Current | | 10.0 | nA | $V_{CB} = 60V$, $I_E = 0$ |
| | | | 10.0 | µA | $V_{CB} = 60V$, $I_E = 0$, $T_A = 150^oC$ |
| $I_{EBO}$ | Emitter-Base Cutoff Current | | 10.0 | nA | $V_{EB} = 4.0V$, $I_C = 0$ |
| $I_{CES}$ | Collector-Emitter Cutoff Current | | 1.00 | µA | $V_{CE} = 50V$ |
| **On Characteristics** | | | | | |
| $h_{FE}$ | Forward-Current Transfer Ratio | 50 | | - | $V_{CE} = 10.0V$, $I_C = 0.1mA$ |
| | | 75 | 325 | - | $V_{CE} = 10.0V$, $I_C = 1.0mA$ |
| | | 100 | | - | $V_{CE} = 10.0V$, $I_C = 10mA$ |
| | | 100 | 300 | - | $V_{CE} = 10.0V$, $I_C = 150mA$(3) |
| | | 30 | | - | $V_{CE} = 10.0V$, $I_C = 500mA$(3) |
| | | 35 | | - | $V_{CE} = 10.0V$, $I_C = 10mA$, $T_A = -55^oC$ |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.30 | V | $I_C = 150mA$, $I_B = 15mA$(3) |
| | | | 1.00 | V | $I_C = 500mA$, $I_B = 50mA$(3) |
| $V_{BE(SAT)}$ | Base-Emitter Saturation Voltage | 0.60 | 1.20 | V | $I_C = 150mA$, $I_B = 15mA$(3) |
| | | | 2.00 | V | $I_C = 500mA$, $I_B = 50mA$(3) |
| **Small-Signal Characteristics** | | | | | |
| $h_{fe}$ | Small-Signal Forward Current Transfer Ratio | 50 | | - | $V_{CE} = 10.0V$, $I_C = 1.0mA$, $f = 1.0kHz$ |
| $\lvert h_{fe} \rvert$ | Small-Signal Forward Current Transfer Ratio | 2.5 | | - | $V_{CE} = 20V$, $I_C = 20mA$, $f = 100MHz$ |
| $C_{obo}$ | Open Circuit Output Capacitance | | 8.0 | pF | $V_{CB} = 10.0V$, $100kHz \leq f \leq 1.0MHz$ |
| $C_{ibo}$ | Input Capacitance (Output Open) | | 33 | pF | $V_{EB} = 0.5V$, $100kHz \leq f \leq 1.0MHz$ |
| **Switching Characteristics** | | | | | |
| $t_{on}$ | Turn-On Time | | 35 | ns | $V_{CC} = 30V$, $I_C = 150mA$, $I_{B1} = 15mA$ |
| $t_{off}$ | Turn-Off Time | | 300 | ns | $V_{CC} = 30V$, $I_C = 150mA$, $I_{B1} = I_{B2} = 15mA$ |

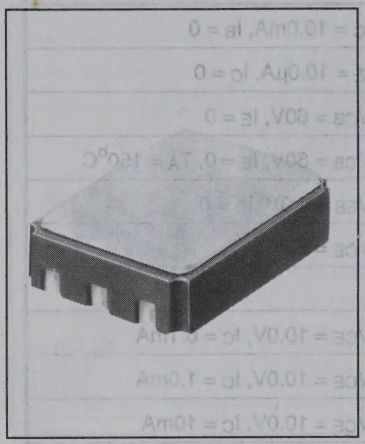
(3) Pulse Test: Pulse width ≤ 300µs, Duty Cycle ≤ 2.0%

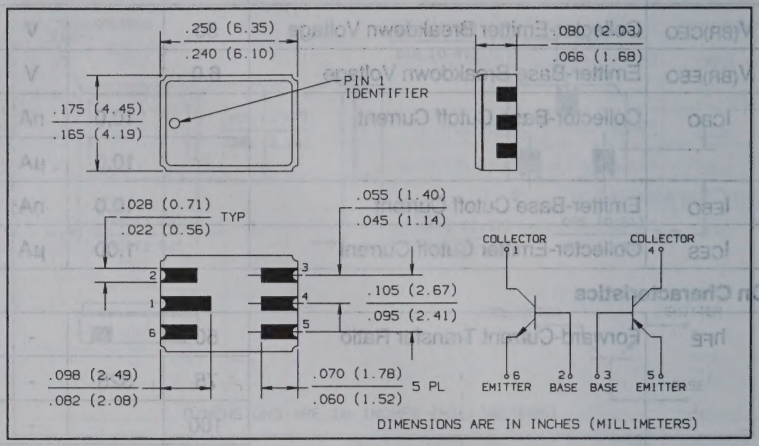
HI REL SURFACE MOUNT

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Surface Mount NPN/PNP Complementary Transistors
# Type HCT700






## Features

- Ceramic surface mount package
- Miniature package to minimize circuit board area
- Electrical performance similar to 2N2222A and 2N2907A
- Hermetically sealed
- Screened per MIL-S-19500 TX or TXV (See JANTX2N4854U)

## Description

The HCT700 is a hermetically sealed, ceramic surface-mount, complementary transistor pair. The HCT700 consists of an NPN transistor die and PNP transisitor die. The HCT700 electrical characteristics for the NPN side are similar to the MIL-S-19500/255 specification for JAN2N2222A and on the PNP side are similar to the MIL-S-10500/291 specification for the JAN2N2907A. The miniature six pin ceramic package is ideal for designs where board space and device weight are important design considerations.

Order HCT700TX or HCT700TXV for TX or TXV processing per MIl-S-19500.

## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| NPN to PNP Isolation Voltage | 500VDC |
| Collector-Base Voltage (NPN) | 75V |
| Collector-Base Voltage (PNP) | 60V |
| Collector-Emitter Voltage (NPN) | 50V |
| Collector-Emitter Voltage (PNP) | 60V |
| Emitter-Base Voltage (NPN) | 6.0V |
| Emitter-Base Voltage (PNP) | 5.0V |
| Collector Current-Continuous (NPN) | 800mA |
| Collector Current-Continuous (PNP) | 600mA |
| Operating Junction Temperature ($T_J$) | -65°C to +200°C |
| Storage Junction Temperature ($T_{stg}$) | -65°C to +200°C |
| Power Dissipation @ $T_A$ = 25°C | 0.4W |
| Power Dissipation @ $T_S$(1) = 25°C | 2.0W(2) |
| Soldering Temperature (vapor phase reflow for 30 sec.) | 215°C |
| Soldering Temperature (heated Collet for 5 sec.) | 260°C |

**Notes:**
(1) $T_S$ = Substrate temperature that the chip carrier is mounted on.
(2) Derate linearly 11.4mW/°C above 25°C.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

# Type HCT700

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

| SYMBOL | PARAMETER | NPN | | PNP | | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| | | MIN | MAX | MIN | MAX | | |
| **Off Characteristics** | | | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 75 | | 60 | | V | $I_C = 10.0\ \mu A$, $I_E = 0$ |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 50 | | 60 | | V | $I_C = 10.0$ mA, $I_B = 0$ |
| $V_{(BR)EBO}$ | Emitter-Base Beakdown Voltage | 6.0 | | 5.0 | | V | $I_E = 10.0\ \mu A$, $I_C = 0$ |
| $I_{CBO}$ | Collector-Base Cutoff Current | | 10.0 | | | nA | $V_{CB} = 60$ V, $I_E = 0$ |
| | | | | | 10.0 | nA | $V_{CB} = 50$ V, $I_E = 0$ |
| | | | 10.0 | | | μA | $V_{CB} = 60$ V, $I_E = 0$, $T_A = 150^oC$ |
| | | | | | 10.0 | μA | $V_{CB} = 50$ V, $I_E = 0$, $T_A = 150^oC$ |
| $I_{EBO}$ | Emitter-Base Cutoff Current | | 10.0 | | | nA | $V_{EB} = 4.0$ V, $I_C = 0$ |
| | | | | | 50.0 | nA | $V_{EB} = 3.5$ V, $I_C = 0$ |
| $I_{CES}$ | Collector-Emitter Cutoff Current | | 1.00 | | | μA | $V_{CE} = 50$ V |
| **On Characteristics** | | | | | | | |
| $h_{FE}$ | DC Current Transfer Ratio | 50 | | 75 | | - | $V_{CE} = 10.0$ V, $I_C = 0.1$ mA |
| | | 75 | 325 | 100 | 450 | - | $V_{CE} = 10.0$ V, $I_C = 1.0$ mA |
| | | 100 | | 100 | | - | $V_{CE} = 10.0$ V, $I_C = 10.0$ mA |
| | | 100 | 300 | 100 | 300 | - | $V_{CE} = 10.0$ V, $I_C = 150.0$ mA(3) |
| | | 30 | | 50 | | - | $V_{CE} = 10.0$ V, $I_C = 500.0$ mA(3) |
| | | 35 | | | | - | $V_{CE} = 10.0$ V, $I_C = 10.0$ mA, $T_A = -55^oC$ |
| | | | | 50 | | - | $V_{CE} = 10.0$ V, $I_C = 1.0$ mA, $T_A = -55^oC$ |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.30 | | 0.40 | V | $I_C = 150$ mA, $I_B = 15$ mA(3) |
| | | | 1.00 | | 1.60 | V | $I_C = 500$ mA, $I_B = 50$ mA(3) |
| $V_{BE(SAT)}$ | Base-Emitter Saturation Voltage | 0.60 | 1.20 | | 1.30 | V | $I_C = 150$ mA, $I_B = 15$ mA(3) |
| | | | 2.00 | | 2.60 | V | $I_C = 500$ mA, $I_B = 50$ mA(3) |
| **Small-Signal Characteristics** | | | | | | | |
| $h_{fe}$ | Small-Signal Current Transfer Ratio | 50 | | 100 | | - | $V_{CE} = 10.0$ V, $I_C = 1.0$ mA, f = 1.0 kHz |
| $\lvert h_{fe} \rvert$ | Small-Signal Current Transfer Ratio | 2.5 | | | | - | $V_{CE} = 20$ V, $I_C = 20$ mA, f = 100 MHz |
| | | | | 2.0 | | - | $V_{CE} = 20$ V, $I_C = 50$ mA, f = 100 MHz |
| $C_{obo}$ | Output Capacitance | | 8.0 | | 8.0 | pF | $V_{CE} = 10.0$ V, 100 kHz ≤ f ≤ 1.0 MHz |
| $C_{ibo}$ | Input Capacitance | | 25 | | | pF | $V_{EB} = 2.0$ V, 100 kHz ≤ f ≤ 1.0 MHz |
| | | | | | 30 | pF | $V_{EB} = 0.5$ V, 100 kHz ≤ f ≤ 1.0 MHz |
| **Switching Characteristics** | | | | | | | |
| $t_{on}$ | Turn-On Time | | 35 | | 45 | ns | $V_{CC} = 30$ V, $I_C = 150$ mA, $I_{B1} = 15$ mA |
| $t_{off}$ | Turn-Off Time | | 300 | | 300 | ns | $V_{CC} = 30$ V, $I_C = 150$ mA, $I_{B1} = I_{B2} = 15$ mA |

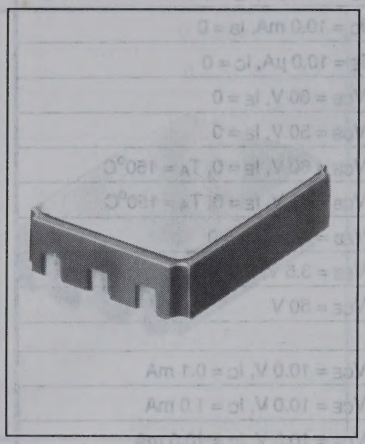
(3) Pulse Test: Pulse Width ≤ 300 ms, duty cycle ≤ 2.0%

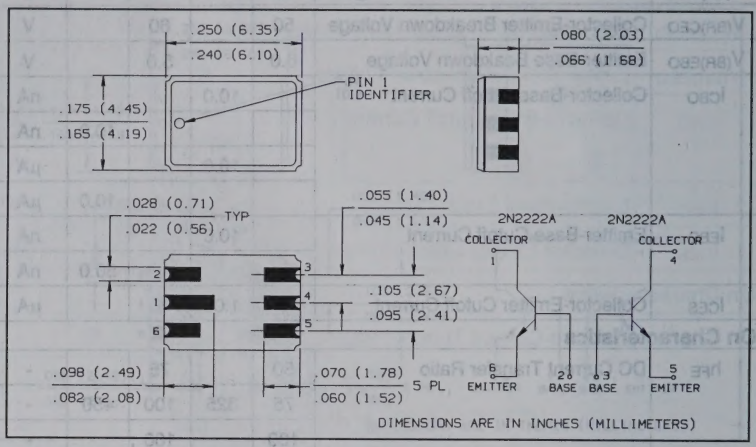
HI REL SURFACE MOUNT

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Surface Mount Dual NPN Transistor
## Type HCT720






### Features

- Surface mountable on ceramic or printed circuit board
- Miniature package to minimize circuit board area required
- Electrical performance similar to 2N2222A
- Hermetically sealed
- Screened per MIL-S-19500 TX or TXV equivalent levels on request

### Description

The HCT720 is a hermetically sealed, ceramic surface-mount device, consisting of two 2N2222A silicon NPN transistor die. The HCT720 electrical characteristics for each transistor are similar to MIL-S-19500/255 specification for the 2N2222A. The miniature six pin ceramic package is ideal for designs where board space and device weight are important design considerations.

TX and TXV screening, if requested, will be performed similar to MIL-S-19500/495 per 2N5794 conditions. Order HCT720TX or HCT720TXV.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Isolation Voltage | 500VDC |
| Collector-Base Voltage | 75V |
| Collector-Emitter Voltage | 50V |
| Emitter-Base Voltage | 6.0V |
| Collector Current - Continuous | 800mA |
| Operating Junction Temperature ($T_J$) | -65°C to +200°C |
| Storage Junction Temperature ($T_{stg}$) | -65°C to +200°C |
| Power Dissipation @ $T_A$ = 25°C (both sides driven equally) | 0.65W |
| Power Dissipation @ $T_S$[1] = 25°C (both sides driven equally) | 1.25W[2] |
| Soldering Temperature (vapor phase reflow for 30 sec.) | 215°C |
| Soldering Temperature (heated collet for 5 sec.) | 260°C |

**Notes**

(1) $T_S$ = Substrate temperature that the chip carrier is mounted on.

(2) Derate linearly 7.1mW/°C above 25°C. This rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measureable as and outgoing test.

# Type HCT720

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

| Symbol | Parameter | Min. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|
| **Off Characteristics** | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 75 | | V | $I_C = 10.0\mu A$, $I_E = 0$ |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 50 | | V | $I_C = 10.0mA$, $I_B = 0$ |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | 6.0 | | V | $I_E = 10.0\mu A$, $I_C = 0$ |
| $I_{CBO}$ | Collector-Base Cutoff Current | | 10.0 | nA | $V_{CB} = 60V$, $I_E = 0$ |
| | | | 10.0 | µA | $V_{CB} = 60V$, $I_E = 0$, $T_A = 150^oC$ |
| $I_{EBO}$ | Emitter-Base Cutoff Current | | 10.0 | nA | $V_{EB} = 4.0V$, $I_C = 0$ |
| $I_{CES}$ | Collector-Emitter Cutoff Current | | 1.00 | µA | $V_{CE} = 50V$ |
| **On Characteristics** | | | | | |
| $h_{FE}$ | Forward-Current Transfer Ratio | 50 | | — | $V_{CE} = 10.0V$, $I_C = 0.1mA$ |
| | | 75 | 325 | — | $V_{CE} = 10.0V$, $I_C = 1.0mA$ |
| | | 100 | | — | $V_{CE} = 10.0V$, $I_C = 10.0mA$ |
| | | 100 | 300 | — | $V_{CE} = 10.0V$, $I_C = 150mA$(3) |
| | | 30 | | — | $V_{CE} = 10.0V$, $I_C = 500mA$(3) |
| | | 35 | | — | $V_{CE} = 10.0V$, $I_C = 10.0mA$, $T_A = -55^oC$ |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.30 | V | $I_C = 150mA$, $I_B = 15mA$(3) |
| | | | 1.00 | V | $I_C = 500mA$, $I_B = 50mA$(3) |
| $V_{BE(SAT)}$ | Base-Emitter Saturation Voltage | 0.6 | 1.20 | V | $I_C = 150mA$, $I_B = 15mA$(3) |
| | | | 2.00 | V | $I_C = 500mA$, $I_B = 50mA$(3) |
| **Small-Signal Characteristics** | | | | | |
| hfe | Forward Current Transfer Ratio | 50 | | — | $V_{CE} = 10.0V$, $I_C = 1.00mA$, $f = 1.0kHz$ |
| Ihfel | Forward Current Transfer Ratio | 2.5 | | — | $V_{CE} = 20V$, $I_C = 20mA$, $f = 100MHz$ |
| $C_{obo}$ | Open Circuit Output Capacitance | | 8.0 | pF | $V_{CB} = 10.0V$, $100kHz \leq f \leq 1.0MHz$ |
| $C_{ibo}$ | Input Capacitance (Output Open) | | 33 | pF | $V_{EB} = 0.5V$, $100kHz \leq f \leq 1.0MHz$ |
| **Switching Characteristics** | | | | | |
| $t_{on}$ | Turn-On Time | | 35 | ns | $V_{CC} = 30V$, $I_C = 150mA$, $I_{B1} = 15mA$ |
| $t_{off}$ | Turn-Off Time | | 300 | ns | $V_{CC} = 30V$, $I_C = 150mA$, $I_{B1} = I_{B2} = 15mA$ |

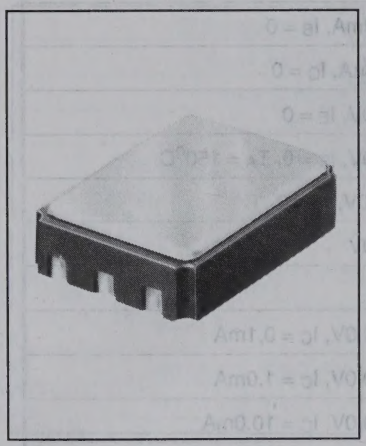
(3) Pulse Test: Pulse Width ≤ 300µs. Duty Cycle ≤ 2.0%

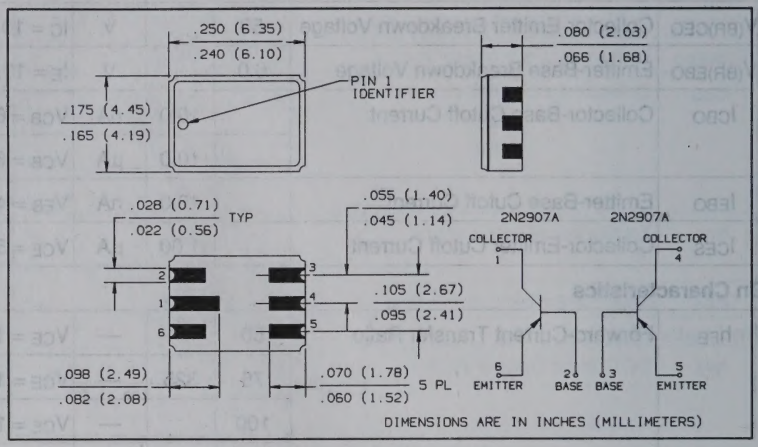
HI REL SURFACE MOUNT

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Surface Mount Dual PNP Transistor
## Type HCT740






### Features

- Surface mountable on ceramic or printed circuit board
- Miniature package to minimize circuit board area required
- Electrical performance similar to 2N2907A
- Hermetically sealed
- Screened per MIL-S-19500 TX or TXV equivalent levels on request

### Description

The HCT740 is a hermetically sealed, ceramic surface-mount device, consisting of two 2N2907A silicon PNP transistor die. The HCT740 electrical characteristics are similar to the MIL-S-19500/291 specification for the 2N2907A. The miniature six pin ceramic package is ideal for designs where board space and device weight are important design considerations.

TX and TXV screening, if requested, will be performed similar to MIL-S-19500/496 per 2N5796 conditions. Order HCT740TX or HCT740TXV.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Isolation Voltage | 500VDC |
| Collector-Base Voltage | 60V |
| Collector-Emitter Voltage | 60V |
| Emitter-Base Voltage | 5.0V |
| Collector Current - Continuous | 600mA |
| Operating Junction Temperature ($T_J$) | -65°C to +200°C |
| Storage Junction Temperature ($T_{stg}$) | -65°C to +200°C |
| Power Dissipation @ $T_A$ = 25°C (Both sides driven equally) | 0 .65W |
| Power Dissipation @ $T_S$(1) = 25°C (Both sides driven equally) | 1.25W(2) |
| Soldering Temperature (vapor phase reflow for 30 sec.) | 215°C |
| Soldering Temperature (heated collet for 5 sec.) | 260°C |

### Notes

(1) $T_S$ = Substrate temperature that the chip carrier is mounted on.
(2) Derate linearly 7.1mW/°C above 25°C. This rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measureable as an outgoing test.

# Type HCT740

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Min. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|
| **Off Characteristics** | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 60 | | V | $I_C$ = 10.0μA, $I_E$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 60 | | V | $I_C$ = 10.0mA, $I_B$ = 0 |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | 5.0 | | V | $I_E$ = 10.0μA, $I_C$ = 0 |
| $I_{CBO}$ | Collector-Base Cutoff Current | | 10.0 | nA | $V_{CB}$ = 50V, $I_E$ = 0 |
| | | | 10.0 | μA | $V_{CB}$ = 50V, $I_E$ = 0, $T_A$ = 150°C |
| $I_{EBO}$ | Emitter-Base Cutoff Current | | 50.0 | nA | $V_{EB}$ = 3.5V, $I_C$ = 0 |
| **On Characteristics** | | | | | |
| $h_{FE}$ | Forward-Current Transfer Ratio | 75 | | — | $V_{CE}$ = 10.0V, $I_C$ = 0.1mA |
| | | 100 | 450 | — | $V_{CE}$ = 10.0V, $I_C$ = 1.0mA |
| | | 100 | | — | $V_{CE}$ = 10.0V, $I_C$ = 10.0mA |
| | | 100 | 300 | — | $V_{CE}$ = 10.0V, $I_C$ = 150mA(3) |
| | | 50 | | — | $V_{CE}$ = 10.0V, $I_C$ = 500mA(3) |
| | | 50 | | — | $V_{CE}$ = 10.0V, $I_C$ = 1.00mA, $T_A$ = -55°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.40 | V | $I_C$ = 150mA, $I_B$ = 15mA(3) |
| | | | 1.60 | V | $I_C$ = 500mA, $I_B$ = 50mA(3) |
| $V_{BE(SAT)}$ | Base-Emitter Saturation Voltage | | 1.30 | V | $I_C$ = 150mA, $I_B$ = 15mA(3) |
| | | | 2.60 | V | $I_C$ = 500mA, $I_B$ = 50mA(3) |
| **Small-Signal Characteristics** | | | | | |
| hfe | Forward Current Transfer Ratio | 100 | | — | $V_{CE}$ = 10.0V, $I_C$ = 1.00mA, f = 1.0kHz |
| Ihfel | Forward Current Transfer Ratio | 2.0 | | — | $V_{CE}$ = 20V, $I_C$ = 50mA, f = 100MHz |
| $C_{obo}$ | Open Circuit Output Capacitance | | 8.0 | pF | $V_{CB}$ = 10.0V, 100kHz ≤ f≤ 1.0MHz |
| $C_{ibo}$ | Input Capacitance (Output Open) | | 30 | pF | $V_{EB}$ = 2.0V, 100kHz ≤ f≤ 1.0MHz |
| **Switching Characteristics** | | | | | |
| $t_{on}$ | Turn-On Time | | 45 | ns | $V_{CC}$ = 30V, $I_C$ = 150mA, $I_{B1}$ = 15mA |
| $t_{off}$ | Turn-Off Time | | 300 | ns | $V_{CC}$ = 30V, $I_C$ = 150mA, $I_{B1}$ = $I_{B2}$ = 15mA |

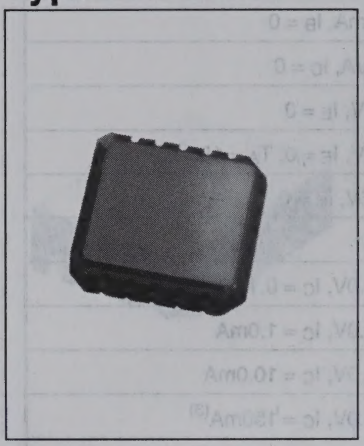
(3) Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2.0%

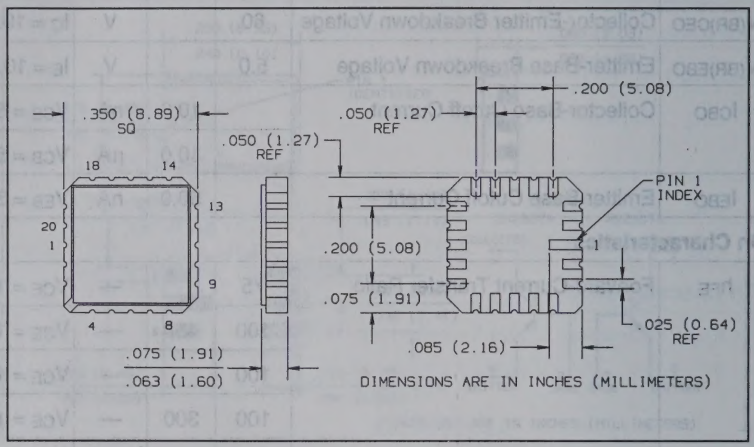
HI REL SURFACE MOUNT

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Surface Mount Quad NPN Transistor
## Type HCT780






### Feature

- Four independent transistors in a 0.35 inch, square ceramic package
- Surface mountable on ceramic or printed circuit board
- Electrical performance similar to a 2N2222A
- Hermetically sealed package
- Screened per MIL-S-19500 TX or TXV equivalent levels on request

### Description

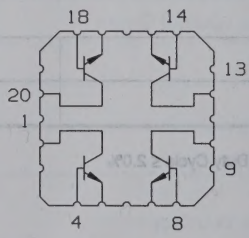
The HCT780 is a 20 pad, hermetically sealed, ceramic surface-mount transistor array, consisting of four 2N2222A silicon NPN transistor die. The HCT780 electrical characteristics are similar to the MIL-S-19500/255 specification for the 2N2222A.

TX and TXV screening, if requested, will be performed similar to MIL-S-19500/559 per 2N6989 conditions. Order HCT780TX or HCT780TXV.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Base Voltage | 75V |
| Collector-Emitter Voltage | 50V |
| Emitter-Base Voltage | 6.0V |
| Collector Current-Continuous | 800mA |
| Isolation Voltage | 500$V_{dc}$ |
| Operating Junction Temperature($T_J$) | -65°C to +200°C |
| Storage Junction Temperature ($T_{stg}$) | -65°C to +200°C |
| Power Dissipation @ $T_A$ = 25°C (four devices driven equally) | 1.0W |
| Power Dissipation @ $T_S$(1) = 25°C (four devices driven equally) | 2.0W(2) |
| Soldering Temperature (vapor phase reflow for 30 sec.) | 215°C |
| Soldering Temperature (heated collet for 5 sec.) | 260°C |

**Notes**
(1) $T_S$ = Substrate temperature that the chip carrier is mounted on.
(2) Derate linearly 11.4mW/°C above 25°C. This rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measureable as an outgoing test.




TOP VIEW

# Type HCT780

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Min. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|
| **Off Characteristics** | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 75 | | V | $I_C$ = 10.0μA, $I_E$ = 0 |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 50 | | V | $I_C$ = 10.0mA, $I_B$ = 0 |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | 6.0 | | V | $I_E$ = 10.0μA, $I_C$ = 0 |
| $I_{CBO}$ | Collector-Base Cutoff Current | | 10.0 | nA | $V_{CB}$ = 60V, $I_E$ = 0 |
| | | | 10.0 | μA | $V_{CB}$ = 60V, $I_E$ = 0, $T_A$ = 150°C |
| $I_{EBO}$ | Emitter-Base Cutoff Current | | 10.0 | nA | $V_{EB}$ = 4.0V, $I_C$ = 0 |
| $I_{CES}$ | Collector-Emitter Cutoff Current | | 1.00 | μA | $V_{CE}$ = 50V |
| **On Characteristics** | | | | | |
| $h_{FE}$ | Forward-Current Transfer Ratio | 50 | | — | $V_{CE}$ = 10.0V, $I_C$ = 0.1mA |
| | | 75 | 325 | — | $V_{CE}$ = 10.0V, $I_C$ = 1.0mA |
| | | 100 | | — | $V_{CE}$ = 10.0V, $I_C$ = 10mA |
| | | 100 | 300 | — | $V_{CE}$ = 10.0V, $I_C$ = 150mA(3) |
| | | 30 | | — | $V_{CE}$ = 10.0V, $I_C$ = 500mA(3) |
| | | 35 | | — | $V_{CE}$ = 10.0V, $I_C$ = 10mA, $T_A$ = -55°C |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.30 | V | $I_C$ = 150mA, $I_B$ = 15mA(3) |
| | | | 1.00 | V | $I_C$ = 500mA, $I_B$ = 50mA(3) |
| $V_{BE(SAT)}$ | Base-Emitter Saturation Voltage | 0.60 | 1.20 | V | $I_C$ = 150mA, $I_B$ = 15mA(3) |
| | | | 2.00 | V | $I_C$ = 500mA, $I_B$ = 50mA(3) |
| **Small-Signal Characteristics** | | | | | |
| hfe | Forward Current Transfer Ratio | 50 | | — | $V_{CE}$ = 10.0V, $I_C$ = 1.0mA, f = 1.0kHz |
| \|hfe\| | Forward Current Transfer Ratio | 2.5 | | — | $V_{CE}$ = 20V, $I_C$ = 20mA, f = 100MHz |
| $C_{obo}$ | Open Circuit Output Capacitance | | 8.0 | pF | $V_{CB}$ = 10.0V, 100kHz ≤ f≤ 1.0MHz |
| $C_{ibo}$ | Input Capacitance (Output Open) | | 25 | pF | $V_{EB}$ = 0.5V, 100kHz ≤ f≤ 1.0MHz |
| **Switching Characteristics** | | | | | |
| $t_{on}$ | Turn-On Time | | 35 | ns | $V_{CC}$ = 30V, $I_C$ = 150mA, $I_{B1}$ = 15mA |
| $t_{off}$ | Turn-Off Time | | 300 | ns | $V_{CC}$ = 30V, $I_C$ = 150mA, $I_{B1}$ = $I_{B2}$ = 15mA |

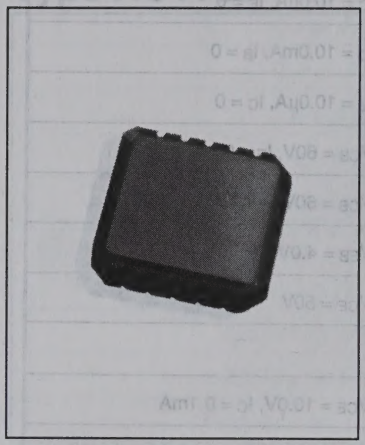
(3) Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2.0%

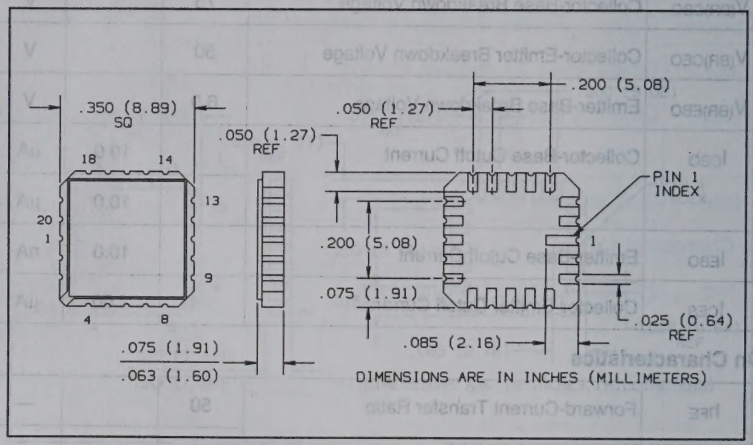
HI REL SURFACE MOUNT

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Surface Mount Quad PNP Transistor
## Type HCT790






### Feature

- Four independent transistors in a 0.35 inch, square ceramic package
- Surface mountable on ceramic or printed circuit board
- Electrical performance similar to a 2N2907A
- Hermetically sealed package
- Screened per MIL-S-19500 TX or TXV equivalent levels on request

### Description

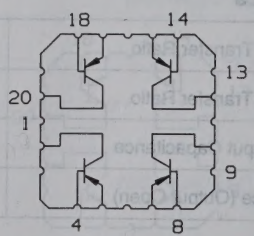
The HCT790 is a 20 pad, hermetically sealed, ceramic surface-mount transistor array, consisting of a 2N2907A silicon PNP transistor die. The HCT790 electrical characteristics are similar to the MIL-S-19500/291 specification for the 2N2907A.

TX and TXV screening, if requested, will be performed similar to MIL-S-19500/558 per 2N6987 conditions. Order HCT790TX or HCT790TXV.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Collector-Base Voltage | 60V |
| Collector-Emitter Voltage | 60V |
| Emitter-Base Voltage | 5.0V |
| Collector Current-Continuous | 600mA |
| Isolation Voltage | 500$V_{DC}$ |
| Operating Junction Temperature($T_J$) | -65°C to +200°C |
| Storage Junction Temperature ($T_{stg}$) | -65°C to +200°C |
| Power Dissipation @ $T_A$ = 25°C (four devices driven equally) | 1.0W |
| Power Dissipation @ $T_S$[(1)] = 25°C (four devices driven equally) | 2.0W[(2)] |
| Soldering Temperature (vapor phase reflow for 30 sec.) | 215°C |
| Soldering Temperature (heated collet for 5 sec.) | 260°C |

**Notes**
(1) $T_S$ = Substrate temperature that the chip carrier is mounted on.
(2) Derate linearly 11.4mW/°C above 25°C. This rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measureable as an outgoing test.




TOP VIEW

# Type HCT790

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

| Symbol | Parameter | Min. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|
| **Off Characteristics** | | | | | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | 60 | | V | $I_C = 10.0\mu A$, $I_E = 0$ |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 60 | | V | $I_C = 10.0mA$, $I_B = 0$ |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | 5.0 | | V | $I_E = 10.0\mu A$, $I_C = 0$ |
| $I_{CBO}$ | Collector-Base Cutoff Current | | 10.0 | nA | $V_{CB} = 50V$, $I_E = 0$ |
| | | | 10.0 | µA | $V_{CB} = 50V$, $I_E = 0$, $T_A = 150^oC$ |
| $I_{EBO}$ | Emitter-Base Cutoff Current | | 50 | nA | $V_{EB} = 3.5V$, $I_C = 0$ |
| **On Characteristics** | | | | | |
| $h_{FE}$ | Forward-Current Transfer Ratio | 75 | | — | $V_{CE} = 10.0V$, $I_C = 0.1mA$ |
| | | 100 | 450 | — | $V_{CE} = 10.0V$, $I_C = 1.0mA$ |
| | | 100 | | — | $V_{CE} = 10.0V$, $I_C = 10.0mA$ |
| | | 100 | 300 | — | $V_{CE} = 10.0V$, $I_C = 150mA$(3) |
| | | 50 | | — | $V_{CE} = 10.0V$, $I_C = 500mA$(3) |
| | | 50 | | — | $V_{CE} = 10.0V$, $I_C = 1.0mA$, $T_A = -55^oC$ |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.40 | V | $I_C = 150mA$, $I_B = 15mA$(3) |
| | | | 1.60 | V | $I_C = 500mA$, $I_B = 50mA$(3) |
| $V_{BE(SAT)}$ | Base-Emitter Saturation Voltage | | 1.30 | V | $I_C = 150mA$, $I_B = 15mA$(3) |
| | | | 2.60 | V | $I_C = 500mA$, $I_B = 50mA$(3) |
| **Small-Signal Characteristics** | | | | | |
| hfe | Forward Current Transfer Ratio | 100 | | — | $V_{CE} = 10.0V$, $I_C = 1.0mA$, $f = 1.0kHz$ |
| \|hfe\| | Forward Current Transfer Ratio | 2.0 | | — | $V_{CE} = 20V$, $I_C = 50mA$, $f = 100MHz$ |
| $C_{obo}$ | Open Circuit Output Capacitance | | 8.0 | pF | $V_{CB} = 10.0V$, $100kHz \leq f \leq 1.0MHz$ |
| $C_{ibo}$ | Input Capacitance (Output Open) | | 30 | pF | $V_{EB} = 2.0V$, $100kHz \leq f \leq 1.0MHz$ |
| **Switching Characteristics** | | | | | |
| $t_{on}$ | Turn-On Time | | 45 | ns | $V_{CC} = 30V$, $I_C = 150mA$, $I_{B1} = 15mA$ |
| $t_{off}$ | Turn-Off Time | | 300 | ns | $V_{CC} = 30V$, $I_C = 150mA$, $I_{B1} = I_{B2} = 15mA$ |

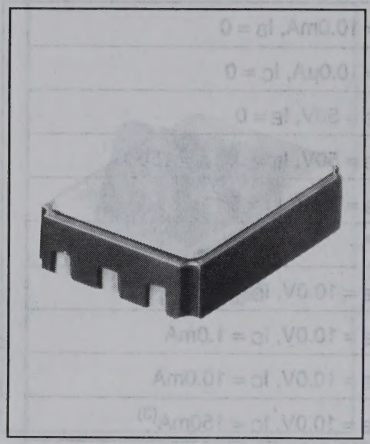
(3) Pulse Test: Pulse Width ≤ 300µs, Duty Cycle ≤ 2.0%

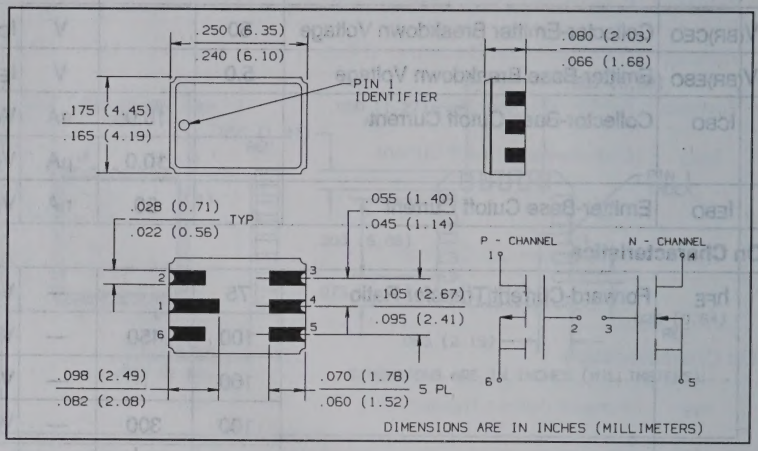
HI REL SURFACE MOUNT

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Dual Enhancement Mode MOSFET
## Type HCT801






### Features

- 6 pad surface mount package
- $V_{DS}$ = 90V
- $I_{D(on)}$ N-Channel = 1.9A
  P-Channel = 0.5A
- Two devices selected for $V_{DS}$, switching time, and capacitance similarity
- Full TX processing available
- Gold plated contacts

### Description

The HCT801 offers an N-Channel and P-Channel MOS transistor packaged in a hermetic ceramic surface mount package. The two devices are similar in performance to the popular VN0109 N-Channel device and VP0109 P-Channel device. These two transistors are particularly well matched for $V_{DS}$, switch time, and capacitance. For closer matching of $I_{D(on)}$, $R_{DS(on)}$ and $G_{fs}$, see the HCT802 data sheet.

Order HCT801TX for processing per MIL-S-19500.

### Absolute Maximum Ratings

Drain-Source Voltage ..... 90V
Gate-Source Voltage ..... ±20V
Drain Current (Limited by Tj max) N-Channel ..... 2A
P-Channel ..... 0.8A
Operating and Storage Temperature ..... -55 to 150°C

### Power Dissipation

$T_A$=25°C(Both devices equally driven) ..... 0.5W Total
$T_S$=25°C (Both devices equally driven) ..... 1.25W Total(1)
($T_S$=Substrate temperature that the package is soldered to)

**Notes**

(1) This rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measureable as an outgoing test.

# Type HCT801

**Electrical Characteristics** ($T_A$ = 25°C unless specified otherwise)

| Symbol | Parameters | Device B=BOTH | Min | Max | Units | Test Condition |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown | B | 90 | | V | $I_D$ = 1mA*, $V_{GS}$ = 0 |
| $V_{TH}$ | Gate Threshold Voltage | N | 0.75 | 2.5 | V | $V_{GS}$ = $V_{DS}$, $I_D$ = 1mA |
| | | P | -1.4 | -3.7 | V | $I_D$ = -1mA |
| $I_{GSS}$ | Gate-body Leakage | B | | ±100 | nA | $V_{GS}$ = ±20V, $V_{DS}$ = 0 |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | B | | 10* | µA | $V_{GS}$ = 0V, $V_{DS}$ = 90V* |
| $I_{D(on)}$ | ON-state Drain Current | N | 0.5 | | A | $V_{GS}$ = 5V*, $V_{DS}$ = 25V* |
| | | P | -0.15 | | A | |
| | | N | 1.9 | | A | $V_{GS}$ = 10V*, $V_{DS}$ = 25V* |
| | | P | -0.5 | | A | |
| $R_{DS(on)}$ | Drain-Source On-Resistance | N | | 5.2 | Ω | $V_{GS}$ = 5V, $I_D$ = 250mA |
| | | N | | 3.2 | Ω | $V_{GS}$ = 10V, $I_D$ = 1A |
| | | P | | 15 | Ω | $V_{GS}$ = -5V, $I_D$ = -0.1A |
| | | P | | 8 | Ω | $V_{GS}$ = -10V, $I_D$ = -0.5A |
| | High Temperature Drain-Source On Resistance | N | | 0.9 | Ω | $V_{GS}$ = 10V, $I_D$ = 1A, $T_A$ = 125°C |
| | | P | | 14 | Ω | $V_{GS}$ = -10V, $I_D$ = -0.5A, $T_A$ = 125°C |
| $G_{fs}$ | Forward Transconductance | N | 250 | | mmho | $V_{DS}$ = 25V*, $I_D$ = 0.5A* |
| | | P | 150 | | mmho | |
| $C_{ISS}$ | Input Capacitance | B | | 70 | pf | $V_{GS}$ = 0V, $V_{DS}$ = 25V*, f = 1MHz |
| $C_{OSS}$ | Common Source Output Capacitance | B | | 35 | pf | |
| $C_{RSS}$ | Reverse Transfer Capacitance | B | | 10 | pf | |
| $t_{(on)}$ | Turn-on-time | B | | 16 | ns | $V_{DD}$ = 25V*, $I_D$ = 1A*, $R_S$=$R_L$=50Ω |
| $t_{(off)}$ | Turn-off-time | B | | 17 | ns | |

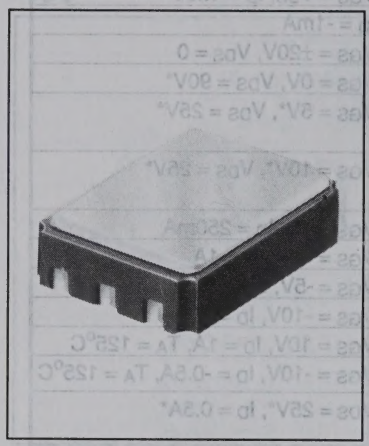
* Reverse polarity for the P-Channel device.

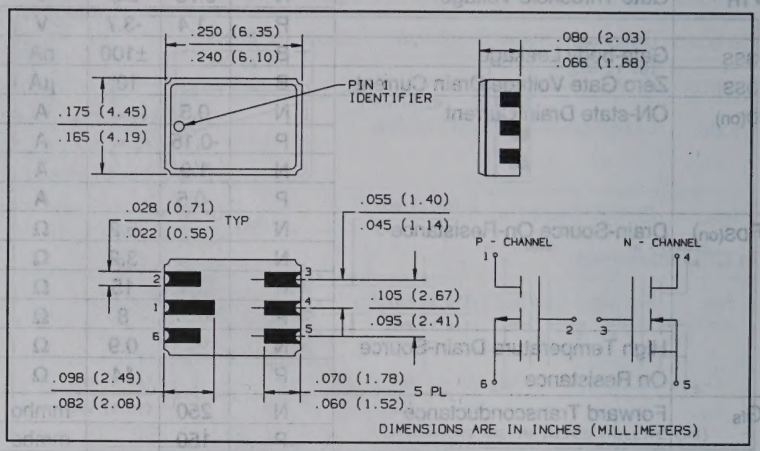
HI REL SURFACE MOUNT

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Dual Enhancement Mode MOSFET
## Type HCT802






### Features

- 6 pad surface mount package
- $V_{DS}$ = 90V
- $R_{DS(on)}$ <5Ω
- $I_{D(on)}$ N-Channel = 1.5A
  P-Channel = 1.1A
- Two devices selected for $V_{DS}$, $I_{D(on)}$ and $R_{DS(on)}$ similarity
- Full TX Processing Available
- Gold plated contacts

### Description

HCT802 offers an N-Channel and P-Channel MOS transistor in a hermetic ceramic surface mount package. The devices used are similar to industry standards VN0109 N-Channel device and VP1008 P-Channel device. These two enhancement mode MOSFETS are particularly well matched for $V_{DS}$, $I_{DS(on)}$, $R_{DS(on)}$ and $G_{fs}$. For closer matching of switching speed and capacitance see the HCT801 data sheet.

Order HCT802TX for processing per Mil-S-19500.

### Absolute Maximum Ratings

Drain-Source Voltage ..... 90V
Gate-Source Voltage ..... ±20V
Drain Current (Limited by Tj max) N-Channel ..... 2A
P-Channel ..... 1.1A
Operating and Storage Temperature ..... -55 to 150°C

### Power Dissipation

$T_A$ = 25°C (Both devices equally driven) ..... 0.5W Total
$T_S$ = 25°C (Both devices equally driven) ..... 1.5W Total(1)
($T_S$ = Substrate that the package is soldered to)

### Notes

(1) This rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measureable as an outgoing test.

# Type HCT802

**Electrical Characteristics** ($T_A$ = 25°C unless specified otherwise)

| Symbol | Parameters | Device B=Both | Min | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown | B | 90* | | V | $I_D$ = 1mA*, $V_{GS}$ = 0 |
| $V_{TH}$ | Gate Threshold Voltage | N | 0.75 | 2.5 | V | $V_{GS}$ = $V_{DS}$, $I_D$ = 1mA |
| | | P | -2.0 | -4.5 | V | $I_D$ = -1mA |
| $I_{GSS}$ | Gate-Body Leakage | B | | ±100 | nA | $V_{GS}$ = ± 20V, $V_{DS}$ = 0 |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | B | | 10* | µA | $V_{DS}$ = 90V*, $V_{GS}$ = 0V |
| | | B | | 500* | µA | Tj = 150°C |
| $I_{D(on)}$ | On-State Drain Current | N | 1.5 | | A | $V_{DS}$ = 25V, $V_{GS}$ = 10V |
| | | P | -1.1 | | A | $V_{DS}$ = -15V, $V_{GS}$ = -10V |
| $R_{DS(on)}$ | Drain-Source on Resistance | B | | 5 | Ω | $V_{GS}$ = 10V*, $I_D$ = 1A* |
| $G_{fs}$ | Forward Transconductance | N | 250 | | mmho | $V_{DS}$ = 25V, $I_D$ = 0.5A |
| | | P | 200 | | mmho | $V_{DS}$ = -10V, $I_D$ = -0.5A |
| $C_{ISS}$ | Input Capacitance | N | | 70 | pf | $V_{DS}$ = 25V, $V_{GS}$ = 0V, f = 1MHz |
| | | P | | 150 | pf | $V_{DS}$ = -25V, $V_{GS}$ = 0V, f = 1MHz |
| $C_{OSS}$ | Common Source Output Capacitance | N | | 35 | pf | $V_{DS}$ = 25V, $V_{GS}$ = 0V, f = 1MHz |
| | | P | | 60 | pf | $V_{DS}$ = -25V, $V_{GS}$ = 0V, f = 1MHz |
| $C_{RSS}$ | Reverse Transfer Capacitance | N | | 10 | pf | $V_{DS}$ = 25V, $V_{GS}$ = 0A, f = 1MHz |
| | | P | | 25 | pf | $V_{DS}$ = -25V, $V_{GS}$ = 0A, f = 1MHz |
| $t_{(on)}$ | Turn-on-time | N | | 15 | ns | $V_{DD}$ = 25V, $I_D$ = 1A, $R_L$ = 50Ω |
| | | P | | 50 | ns | $V_{DD}$ = -25V, $I_D$ = -0.5A, $R_L$ = 50Ω |
| $t_{(off)}$ | Turn-off-time | N | | 17 | ns | $V_{DD}$ = 25V, $I_D$ = 1A, $R_L$ = 50Ω |
| | | P | | 50 | ns | $V_{DD}$ = -25V, $I_D$ = -0.5A, $R_L$ = 50Ω |

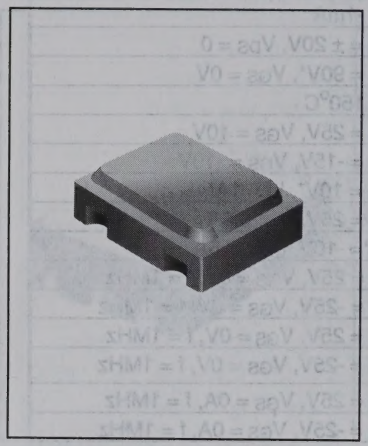
* Reverse polarity for P-Channel device

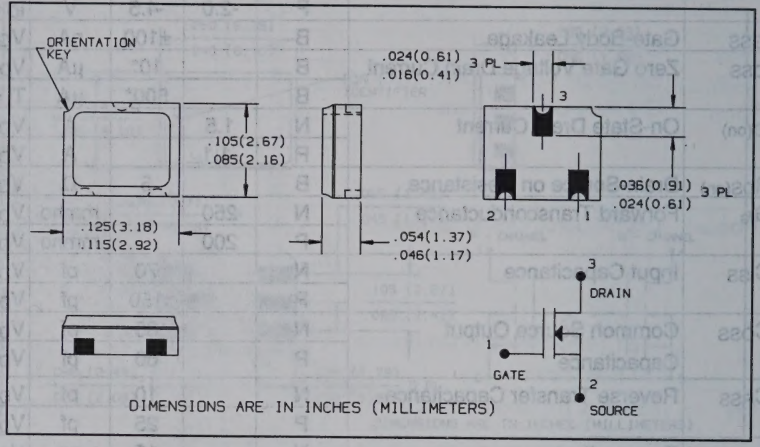
HI REL SURFACE MOUNT

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# N-Channel Enhancement Mode MOS Transistor
## Type HCT7000M






### Features

- 200mA $I_D$
- Ultra small surface mount package
- $R_{DS(ON)} < 5\Omega$
- Pin-out compatible with most SOT23 MOSFETS

### Description

The HCT7000M is a high performance enhancement mode N-channel MOS transistor chip packaged in the ultra small 3 pin ceramic LCC package. Electrical characteristics are similar to those of the JEDEC 2N7000. The pin-out and footprint matches that of most enhancement mode MOS transistors built in SOT23 plastic packages.

The HCT7000M is available processed to TX and TXV levels per MIL-S-19500. Order HCT7000MTX or HCT7000MTXV.

### Absolute Maximum Ratings

| | |
|---|---|
| Drain-Source Voltage | 60V |
| Gate-Source Voltage | ±40V |
| Drain Current | 200mA |
| Power Dissipation ($T_A = 25^oC$) | 300mW |
| Power Dissipation ($T_S^{(1)} = 25^oC$) | 600mW(2) |
| Operating and Storage Temperature | -55°C to +150°C |
| Thermal Resistance $R_{\theta JC}$ | 100°C/W |
| Thermal Resistance $R_{\theta JA}$ | 583°C/W |

**Notes:**
(1) $T_S$ = Substrate temperature that the chip carrier is mounted on.
(2) This rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measurable as an outgoing test.

# Types HCT7000M

**Electrical Characteristics** ($T_A = 25^oC$ unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITION |
|---|---|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | 60 | | V | $V_{GS}$ = 0 V, $I_D$ = 10 µA |
| $V_{GS(TH)}$ | Gate Threshold Voltage | .8 | 3.0 | V | $V_{DS} = V_{GS}$, $I_D$ = 1 mA |
| $I_{GSS}$ | Gate Leakage | | ±10 | nA | $V_{DS}$ = 0 V, $V_{GS}$ = ±15 V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | | 1 | µA | $V_{GS}$ = 0 V, $V_{DS}$ = 48 V |
| $I_{D(ON)}$ | On-State Drain Current | 75 | | mA | $V_{DS}$ = 10 V, $V_{GS}$ = 4.5 V |
| $R_{DS(ON)}$ | Drain-Source on-Resistance | | 5 | Ω | $V_{GS}$ = 10 V, $I_D$ = .5 A |
| $V_{DS(ON)}$ | Drain-Source on-Voltage | | 2.5 | V | $V_{GS}$ = 10 V, $I_D$ = .5 A |
| $G_{fs}$ | Forward Transconductance | 100 | | mS | $V_{DS}$ = 10 V, $I_D$ = .2 A |
| $C_{iss}$ | Input Capacitance | | 60 | pF | $V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1MHz |
| $C_{oss}$ | Output Capacitance | | 25 | pF | |
| $C_{rss}$ | Reverse Transfer Capacitance | | 5 | pF | |
| $t_{(on)}$ | Turn-on Time | | 10 | ns | $V_{DD}$ = 15 V, $I_D$ = .5 A, $V_{gen}$ = 10 V, $R_g$ = 25 Ω |
| $t_{(off)}$ | Turn-off Time | | 10 | ns | |



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

Product Bulletin HCT7000M
April 1993

## N-Channel Enhancement Mode MOS Transistor
## Type HCT7000M

### Features

- 60V $V_{DSS}$
- Ultra small surface mount package
- $R_{DS(ON)} < 3\Omega$
- Pin-out compatible with most SOT23 MOSFETS

### Description

The HCT7000M is a high performance enhancement mode N-channel MOS transistor chip packaged in the ultra small 3 pin ceramic LCC package. Electrical characteristics are similar to those of the JEDEC 2N7000. The pinout and footprint material that of most enhancement mode MOS transistors built in SOT23 plastic packages.

The HCT7000M is available processed to TX and TXV levels per MIL-S-19500. Order HCT7000MTX or HCT7000MTXV.

**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | MAX | UNITS | TEST CONDITION |
|---|---|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | 60 | | V | $V_{GS}$ = 0V, $I_D$ = 10µA |
| $V_{GS(TH)}$ | Gate Threshold Voltage | .8 | 3.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 1mA |
| $I_{GSS}$ | Gate Leakage | | ±10 | nA | $V_{DS}$ = 0 V, $V_{GS}$ = ±15 V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | | 1 | µA | $V_{GS}$ = 0 V, $V_{DS}$ = 48 V |
| $I_{D(ON)}$ | On-State Drain Current | 75 | | mA | $V_{GS}$ = 10 V, $V_{DS}$ = 4.5 V |
| $R_{DS(ON)}$ | Drain-Source on-Resistance | | 5 | Ω | $V_{GS}$ = 10 V, $I_D$ = .5 A |
| $V_{DS(ON)}$ | Drain-Source on-Voltage | | 2.5 | V | $V_{GS}$ = 10 V, $I_D$ = .5 A |
| $G_{fs}$ | Forward Transconductance | 100 | | mS | $V_{DS}$ = 10 V, $I_D$ = .2 A |
| $C_{iss}$ | Input Capacitance | | 60 | pF | $V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1MHz |
| $C_{oss}$ | Output Capacitance | | 25 | pF | |
| $C_{rss}$ | Reverse Transfer Capacitance | | 8 | pF | |
| $t_{(on)}$ | Turn-on Time | | 10 | ns | $V_{DS}$ = 15 V, $I_D$ = .5 A, $V_{gen}$ = 10 V, $R_G$ = 25 Ω |
| $t_{(off)}$ | Turn-off Time | | 10 | ns | |

### Absolute Maximum Ratings

Drain-Source Voltage ..... 60V
Gate-Source Voltage ..... ±40V
Drain Current ..... 200mA
Power Dissipation ($T_A$ ≤ 25°C) ..... 300mW
Power Dissipation ($T_S$[1] = 25°C) ..... 800mW
Operating and Storage Temperature ..... -55°C to +150°C
Thermal Resistance $R_{\theta JS}$ ..... 100°C/W
Thermal Resistance $R_{\theta JA}$ ..... 583°C/W

Notes:
(1) $T_S$ = Substrate temperature that the chip carrier is mounted on.
(2) The rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measurable as an outgoing test.

OPTEK TECHNOLOGY, INC.

# GLOSSARY



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton. Texas 75006 (214)323-2200 Fax (214)323-2396

# Glossary of Symbols and Terms

OPTEK

| Term | Symbol | Description |
|---|---|---|
| Acceptance Angle | $\Theta$ | The maximum angle which a ray may traverse and still be detected by a photosensor, usually measured from the optical axis. |
| Acceptance Cone | – | A cone with an included angle such that any ray within the cone will be detected by the sensor and any ray outside will not. |
| Ambient Temperature | $T_A$ | Temperature of air or liquid surrounding any electrical part or device. |
| Angstrom | Å | $10^{-10}$ meter; a unit of length sometimes used to describe wavelength of optical radiation. |
| Anode | A | The positive terminal of a diode, i.e., the terminal which must have a positive voltage relative to the other terminal (cathode) before the device will conduct. |
| Aperture | – | A hole or window in an opaque material, used to control the transmission of light. |
| Aperture Angle | $\Theta$ | For radiation sources, the angle between the half power points. See Beam Angle. |
| Axis of Measurement | – | The direction from the source of radiant energy, relative to the optical axis, in which the measurement of radiometric and/or spectroradiometric characteristics is preferred. |
| Base | B | The control terminal of a transistor. In a phototransistor, control is provided by light or infrared energy which falls on the transistor and generates a current in the base. |
| Beam Angle | $\Theta$ | A measure of the angular displacement of emitted energy, usually measured as the included angle from one half power point to the other. |
| Beam Half Angle | – | A measure of the angular displacement of emitted energy, generally measured from the optical axis to the half power point. See Emission Angle. |
| Blackbody | – | Ideally, a body that would absorb all and reflect none of the radiant energy falling upon it; its reflectivity would be zero and its absorbency (and consequently its emissivity) would be 100%. In practice, a radiator of uniform temperature whose radiant emittance in all parts of the spectrum is the maximum obtainable from any temperature radiation at the same temperature, or a radiator whose spectral radiant emittance conforms with Planck's law of radiation. |
| Buffer Amp Linearity, Low Voltage | $V_{LL}$ | Output voltage from the buffer of the ABC sensor with a specified input voltage applied to the buffer. |
| Cathode | K | The negative terminal of a diode, i.e., the terminal which must have a negative voltage relative to the other terminal (anode) before the device will conduct. |
| Collector | C | The positive current carrying terminal of an NPN transistor. |
| Collector-Base Breakdown Voltage | $V_{(BR)CBO}$ | The reverse bias voltage at which the collector-base junction of a transistor will conduct a specified (non-destructive) current much higher than the normal leakage currents that occur at lower voltages. In an NPN transistor, it is measured with the collector positive, the base negative, and the emitter open. |
| Collector Current | $I_C$ | The amount of current flowing into the collector terminal of a transistor. |
| Collector-Emitter Breakdown Voltage | $V_{(BR)CEO}$ | The voltage at which a transistor, biased in the normal direction with no optical or electrical input to the base, will conduct a specified (non-destructive) current much higher than the normal leakage currents which occur at lower voltages. |
| Collector-Emitter Saturation Voltage | $V_{CE(SAT)}$ | The collector-emitter voltage of a transistor which is turned "on" by an optical or electrical input to the base, measured under specified conditions of input level and output current load. |
| Color Temperature | – | The temperature of a blackbody having the same visible color as that of a given non-blackbody radiator. |

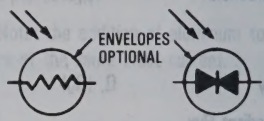
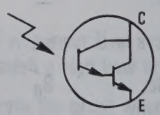
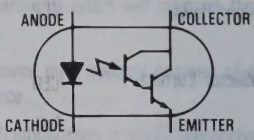
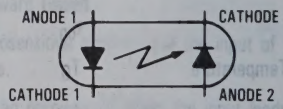
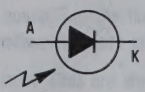
| Term | Symbol | Description |
|---|---|---|
| Common Emitter | — | A circuit configuration in which the emitter terminal is common to both input and output current loops; also called grounded emitter. |
| Commutating dV/dt | — | A changing voltage. In a triac the ability to block this rapidly changing voltage. |
| Conversion Efficiency, Photovoltaic Diode | — | The ratio of maximum available power output resulting from photovoltaic operation to total incident radiant flux. |
| Critical Angle | $\theta_C$ | The maximum angle of incidence for which light will be transmitted from one medium to another. Light approaching at a greater angle of incidence will be reflected. |
| Current Transfer Ratio | CTR | In an optically coupled isolator, the ratio of output (transistor) current to input (LED) current under specified conditions. |
| Dark Condition | — | The condition attained when the electrical parameter under consideration approaches a value which cannot be altered by further irradiation shielding. |
| Dark Current | $I_D$ | The current that flows through a photodetector when there is no optical input; usually used in reference to photodiodes. |
| DC Current Gain | $H_{FE}$ | The ratio of collector current to base current in a transistor biased in the common emitter configuration. |
| DC or AC Input-to-Output Current; Isolation Voltage | $I_{IO}$ | The current between all input terminals shorted together and all output terminals shorted together at a specified voltage. |
| DC or AC Input-to-Output Voltage; Isolation Voltage | $V_{IO}$ | The voltage applied between all input terminals shorted together and all output terminals shorted together. |
| Delay Time | $t_d$ | The time elapsed between a step increase in the input and a change in the output equal to 10% of its maximum change. |
| Detector Noise Current | $I_n$ | The broadband output noise current. |
| Diode | — | A two terminal device (usually semiconductor) which freely conducts current in one direction and blocks it in the other. |
| Duty Cycle | dc | In a signal composed of regularly recurring pulses, the product of the pulse width and the repetition frequency multiplied by 100 to give a percentage. |
| Duty Factor | — | In a signal composed of regularly recurring pulses, the product of the pulse width and the repetition frequency. Same as duty cycle except that it is expressed as a ratio rather than a percentage. |
| Emission Angle | — | For radiation sources, the angle with respect to the optical axis at which the radiant power is half the maximum. |
| Emitter | E | The negative current carrying terminal of an NPN transistor. |
| Emitter (Radiometric) | — | In radiometrics, a source of radiation. |
| Emitter-Collector Breakdown Voltage | $V_{(BR)ECO}$ | The voltage at which a transistor, biased opposite its normal direction with no optical or electrical input to the base, will conduct a specified (non-destructive) current much higher than the normal leakage currents which occur at lower voltages. |
| Emitter Current | $I_E$ | The value of current flowing in the emitter terminal of a transistor. |
| Fall Time | $t_f$ | The time that elapses while a pulse waveform decreases from 90% to 10% of its maximum value. |

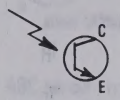
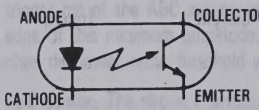
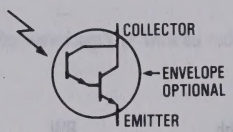
# Glossary of Symbols and Terms

OPTEK

| Term | Symbol | Description |
|---|---|---|
| Fiber Optics | — | Generally, the technology of using transparent glass or plastic fibers which carry light. Signals can be sent over large distances at high speed by coupling optoelectronic devices via fiber optics. |
| Flux Density, Luminous or Radiant Intensity | — | The quotient of (1) the respective luminous or radiant flux at a surface divided by (2) the area of the surface. |
| Forward Bias Voltage | $V_F$ | An external voltage applied in the conducting direction of a PN junction. The positive terminal is connected to the P-type region, and the negative terminal to the N-type region. |
| Forward Current | $I_F$ | The current which flows across a semiconductor junction when a forward-bias voltage is applied. |
| Forward Voltage | $V_F$ | The voltage across a diode when it is forward biased at a specified current. |
| Frequency | $f$ | The number of recurrences of a periodic phenomenon in a unit of time. Usually expressed in hertz (Hz), which is the number of recurrences per second. |
| Gallium Aluminum Arsenide | GaAlAs | A crystalline compound used to make IREDs. Note: the addition of aluminum to the GaAs roughly doubles the power output of the device at the same input current. |
| Gallium Arsenide | GaAs | A crystalline compound used to make IREDs. |
| Half-Density Beam Angle | $\Theta$ | The full-cone angle within which the radiant intensity is not less than half of the maximum intensity. See also Beam Angle. |
| Half Power Point | HP | For radiation sources, the point in the radiation pattern at which the radiant intensity is half the maximum. |
| High Level Output Voltage | $V_{OH}$ | The voltage on the output terminal of a logic circuit with input level and output load applied that, according to the product specification, will establish a high level at the output. |
| High Level Supply Current | $I_{CCH}$ | In a logic circuit, the supply current required to operate the circuit when input conditions are such that the output is in the high logic state. |
| Holding Current | $I_H$ | In a triac, the minimum current through the main terminals which will maintain the device in the on-state in the absence of an input to the gate. |
| Illuminance (Illumination); Irradiance | E | The respective luminous or radiant flux density incidence on a surface; quotient of the flux divided by the area of illuminated or irradiated surface. |
| Infrared | IR | Optical radiation that is characterized by wavelength longer than normally pereceived by the eye, but shorter than radio waves. Optek emitters radiate in the infrared range. |
| Infrared Emitting Diode | IRED | A diode which emits infrared radiation when forward biased. |
| Input-to-Output Capacitance | $C_{IO}$ | The capacitance between the output of the photosensitive element and the input of the photoemitter element, called coupling capacitance. |
| Input-to-Output Resistance | $R_{IO}$ | The resistance between the input and output of an optoisolator when the input leads are shorted together and the output leads are shorted together. |
| Interrupter Assembly | — | Same as Transmissive Assembly. |
| Irradiance | $E_e$ | The radiant flux density incident on a surface; the quotient of the flux divided by the area of the irradiated surface. Units: watts/square meter, milliwatts/square cm. |
| Isolation Leakage Current | $I_{ISO}$ | The current produced in an optoisolator when the input leads are shorted together, the output leads are shorted together, and a specified voltage is applied between the input and output. |

| Term | Symbol | Description |
|---|---|---|
| Isolation Voltage | $V_{ISO}$ | The input-to-output voltage withstanding capability of an optically coupled isolator. |
| Junction Temperature | $T_J$ | The temperature at the PN junction within a semiconductor device. |
| Light | — | Optical radiation in the range of wavelengths which can be perceived by the human eye. |
| Light Current | $I_L$ | Current flow through a photosensitive device when exposed to radiant energy. |
| Light-Emitting Diode (LED) | — | A device capable of emitting luminous energy resulting from the recombination of electrons and holes |
| Low Level Output Voltage | $V_{OL}$ | The voltage on the output terminal of a logic circuit with input level and output loading applied such that, according to the product specification, a low level at the output will be established. |
| Low Level Supply Current | $I_{CCL}$ | In a logic circuit, the supply current required to operate the circuit when the input conditions are such that the output is in the low logic state. |
| Lower Ramp Threshold Voltage | $V_{RL}$ | The lower threshold voltage of the RC pin on the ABC sensor. The circuit discharges a capacitor connected to this pin until the voltage on the capacitor reaches the lower threshold voltage. |
| Luminous Energy | Q, ($Q_V$) | Energy traveling in the form of visible radiation. |
| Luminous Flux, Radiant Flux | — | The respective time rate of flow of luminous or radiant energy. |
| Maximum Power Dissipation | $P_{D(MAX)}$ | Maximum power that a device can safely dissipate under specified conditions which include ambient temperature, heat sinking, and air circulation. |
| Micron | — | $10^{-6}$ meter. |
| Nanometer | nm | $10^{-9}$ meter; equal to 10 angstroms or $10^{-3}$ micron. |
| Noise Equivalent Bandwidth | $B_n$ | The equivalent bandwidth of a flat (or white) noise spectrum with sharp cutoff and the same maximum value that contains the same noise power as the actual broadband output noise power of the device or current. |
| Noise Equivalent Power | NEP | The radiant flux at a specific wavelength incident on a detector which gives a signal-to-noise ratio of unity. Unit: watts. |
| Off-State Collector Current | $I_{CEO}$ | The collector current in a transistor with no optical or electrical input to the base. |
| Off Time | $t_{off}$ | Storage time plus fall time. |
| On-State Collector Current | $I_{C(ON)}$ | The output (collector) current of a transistor when there is a specified optical or electrical input to the base. |
| On Time | $t_{on}$ | Delay time plus rise time. |
| Operating Temperature | $T_O$ | The temperature or range of temperatures over which a device is expected to operate within specified performance limits. |
| Optical Axis | — | A line about which the radiant energy pattern is centered; usually perpendicular to the active area. |
| Optical Radiation | — | Electromagnetic radiation in the range of wavelengths from 10 nanometers (extreme ultraviolet) to 1 millimeter (extreme infrared). |
| Optically Coupled Isolator | — | A device that is designed for transferring electrical signals by utilizing optical energy to provide coupling, with electrical isolation between input and output. Optically coupled isolators usually consist of an IRED coupled to one of a variety of sensor types, shielded from ambient light. |

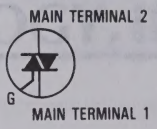
| Term | Symbol | Description |
|---|---|---|
| Optically Coupled Triac Driver | — | An optically coupled isolator whose output is designed to control the gate of a power triac. |
| Optocoupler | — | See Optically Coupled Isolator. |
| Optoelectronic Device | — | A device which responds to, emits, or modifies electromagnetic radiation in the visible, infrared, and/or ultraviolet spectral regions, or a device that utilizes such radiation for its internal operation. |
| Optoisolator | — | See Optically Coupled Isolator. |
| Peak On-State Surge Current | $I_{TM(SURGE)}$ | An on-state current of short duration and specified waveshape which represents the maximum current surge capacity of a triac. |
| Peak Wavelength | $\lambda p$ | The wavelength at which the power output of an emitter is maximum. |
| Photoconductive Diode | — | A photodiode that is intended to be used as a photoconductive transducer. |
| Photoconductive Transducer | — | A device that is intended to change its conductance as a function of incident light or radiation.   |
| Photocoupler | — | See Optically Coupled Isolator. |
| Photocurrent | — | The difference between light current and dark current in a photodetector. |
| Photodarlington | — | A photosensor consisting of two transistors on a single chip, configured such that the current from the first (photosensitive) transistor is amplified by the gain of the second transistor. Note: photodarlingtons have very high current output compared to phototransistors but speed and linearity are relatively poor.   |
| Photodarlington Coupler | — | An optocoupler in which the photosensitive element is a darlington-connected phototransistor.   |
| Photodiode, Avalanche | — | A photodiode that is intended to take advantage of avalanche multiplication of photocurrent. |
| Photodiode Coupler | — | An optocoupler in which the photosensitive element is a photodiode.   |
| Photodetector | — | A device that responds electrically when exposed to radiant energy. |
| Photodiode | — | A diode which is sensitive to incident radiation. Incident photons cause the diode to conduct (if reverse biased) or to generate a current. Note: photodiodes typically have much less output current than phototransistors but are faster and more linear.   |

| Term | Symbol | Description |
|---|---|---|
| Photoemissive Device | — | Synonym for a photoemitter. |
| Photoemitter | — | A device that emits electromagnetic radiation in the visible, infrared, and/or ultraviolet spectral regions. |
| Photologic™ Coupler | — | An optocoupler in which the photosensitive element is a digital output integrated circuit. |
| Photon | — | A quantum (the smallest possible unit) of radiant energy; a photon carries a quantity of energy equal to Planck's constant times the frequency. |
| Photosensitive Device | — | A device that is responsible to electro-magnetic radiation in the visible, infrared, and/or ultraviolet spectral regions. |
| Photosensor | — | A device which controls or generates an electric current when irradiated by light. |
| Phototransistor | — | A transistor which is sensitive to incident radiation. The incident photons result in a base current which is then amplified by the gain of the transistor.   |
| Phototransistor Coupler | — | An optocoupler in which the photosensitive element is a phototransistor.   Note: The base region may or may not be brought out as an electrical terminal. |
| Phototransistor, Darlington Connected | — | A phototransistor, the collector and emitter of which are connected to the collector and base, respectively, of a second transistor.   Note: The base regions may or may not be brought out as electrical terminals. |
| Phototriac Driver Coupler | — | An optocoupler in which the photosensitive element is either a zero current crossing triac driver or a zero voltage crossing driver. |
| Point Source | — | A radiation source with a maximum diameter less than $1/10$ the distance between source and detector. |
| Propagation Delay | $t_{PLH}$, $t_{PHL}$ | In a logic circuit, the time delay between a specified change in input and a corresponding change in the output logic state. $t_{PLH}$ is measured with the output changing from low to high and $t_{PHL}$ with the output changing from high to low. |
| Radiance | N, $L_e$ | The radiant intensity of the energy leaving or passing through a surface, divided by its area. |
| Radiant Efficiency | — | The ratio of the total radiant flux emitted to the total input power. |
| Radiant Flux | $\Phi_e$ | Rate of flow of radiant energy, expressed in watts. |
| Radiant Intensity | $I_e$ | The radiant flux generated per unit solid angle in a given direction, expressed in milliwatts per steradian (mW/sr). |
| Radiation Pattern | — | The representation of the intensity of emission as a function of direction, in a given plane. |
| Radiometric | — | Of or pertaining to radiation in all wavelengths. |

# Glossary of Symbols and Terms

OPTEK

| Term | Symbol | Description |
|---|---|---|
| Ramp Leakage Current | $I_{RL}$ | In the ABC sensor, the current that flows through the RC pin (pins) when the device is operated under specified conditions. |
| Reflective Assembly | — | A device in which an IRED and a photosensor are mounted side by side, such that the photosensor is only irradiated when a reflective object passes in front of the device. Reflective assemblies are used to sense the presence of reflective objects. |
| Repetitive Peak Off-State Current | $I_{DRM}$ | In a triac, the maximum instantaneous value of the off-state current that results from the application of repetitive peak off-state voltage. |
| Responsivity | R | A description of the optical sensitivity of a photosensor. It is the ratio of the output current or voltage to the input radiant flux, typically expressed as amps per watt or volts per watt. |
| Reverse Breakdown Voltage | $V_{(BR)R}$ | The reverse bias voltage at which a diode will conduct a specified (non-destructive) current much higher than the normal leakage currents which occur at lower voltages. |
| Reverse Current | $I_R$ | The current that flows when a reverse bias voltage is applied to a semiconductor junction. |
| Rise Time | $t_r$ | The time that elapses while a pulse waveform increases from 10% to 90% of its maximum value. |
| RMS On-State Current | $I_{T(RMS)}$ | In a triac, the principal current when the device is in the on-state. |
| Silicon | Si | An element, abundant in the earth's crust, which is used in highly purified form to make most of the semiconductors used in the modern electronics industry (including all Optek photodetectors). Pure crystalline silicon is carefully "doped" with very small amounts of impurities to control its electrical characteristics. |
| Snell's Law | — | The law of refraction which predicts the behavior of electromagnetic radiation as it passes from one homogeneous isotropic media to another; expressed as $n1\sin\Theta1 = n2\sin\Theta2$ where n1 and n2 are refractive indices and $\Theta1$, $\Theta2$, refer to the angles between the rays and the normal to the interface. |
| Spectral Bandwidth | BW | The wavelength interval in which a photometric or radiometric spectral quantity is not less than half of its maximum value. |
| Spectral Response | — | A description of the electrical output characteristic versus wavelength of radiation incident upon a device, usually expressed by a curve. |
| Static dV/dt | dV/dt | The measure of the ability of a triac or SCR to block a rapidly rising voltage. Static dV/dt is usually measured with application of full rated voltage to the device in a very short but controlled time period. It is expressed in volts/microsecond. |
| Static Gate Trigger Current | $I_{GT}$ | In a triac, the minimum gate current required to switch the device from the off-state to the on-state. |
| Steradian | sr | The solid angle subtending an area on the surface of a sphere equal to the square of the sphere's radius. There are $4\pi$ steradians in a sphere. |
| Storage Temperature | $T_{STG}$ | The maximum temperature at which a device may be stored with no power applied. |
| Storage Time | $t_s$ | The time elapsed between a step decrease in the input and a change in the output equal to 10% of its maximum change. |
| Supply Voltage | $V_{CC}$ | The power supply voltage required to operate a circuit. |
| Total Power Output | $P_O$ | The total power that is radiated by a device, expressed in watts or milliwatts. |

| Term | Symbol | Description |
|---|---|---|
| Transistor | — | A three terminal active semiconductor device which is capable of providing power amplification. |
| Transmissive Assembly | — | A device in which an IRED and a photosensor are mounted facing each other on either side of a slot, such that an opaque object passing through the slot will interrupt the $I_R$ radiation path and be detected by the photosensor. |
| Triac | — | A five layer semiconductor device which provides switching action for either polarity of applied voltage and can be controlled in either polarity by a single gate electrode. Triacs are usually used in power control applications.   |
| Trigger Leakage | $I_{T1}$, $I_{T2}$ | The current that flows in the trigger terminal of the ABC sensor. $I_{T1}$ is measured with the trigger pin at ground potential and $I_{T2}$ with the trigger pin at $V_{CC}$ potential. |
| Trigger Voltage | $V_T$ | The minimum voltage which, when applied to the trigger pin of the ABC sensor, will force the RC pin to sink current. Once triggered by a rising edge of this minimum amplitude, the RC pin sinks current until the voltage on the capacitor reaches the lower ramp threshold voltage. |
| Upper Ramp Threshold Voltage | $V_{RU}$ | The upper threshold voltage of the RC pin on the ABC sensor. The circuit charges a capacitor connected to this pin until the voltage on the capacitor reaches the upper threshold voltage. |
| Visible-Light-Emitting Diode | VLED | Synonym for light-emitting diode. |
| Wavelength | $\lambda$ | The velocity of a wave divided by its frequency. The wavelength of infrared radiation is usually expressed in nanometers. |

# Glossary of Symbols and Terms

OPTEK TECHNOLOGY, INC.

# APPLICATION BULLETINS



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

# Thermal behavior of GaAs LEDs

Table of Contents

| | Page |
|---|---|
| 1. Introduction | 1 |
| 2. Thermal Parameters | 1 |
| 3. Temperature Response to a Thermal Power Step | 2 |
| 4. Temperature Response to a Thermal Power Pulse | 3 |
| 5. Temperature Response to Recurrent Thermal Pulses | 4 |
| 6. Power Droop | 5 |
| 7. Conclusion | 6 |
| 8. Formulae Summary | 6 |

## Introduction

The output power ($P_O$) of a GaAs LED is a function of forward current ($I_F$). As this forward current increases, the output power will also increase. This forward current flowing through the LED generates heat ($P_D$) which causes the junction temperature ($\theta_j$) of the diode to increase. As the junction temperature increases, the output power decreases.

To obtain optimum operating conditions for a GaAs LED, the knowledge of the different thermal parameters and their influence on the major electro-optical parameters must be known. The purpose of this bulletin is to introduce these thermal parameters to the reader and provide a way to use them. Data will be presented and formulae will be given that will allow readers to determine if their system meets manufacturer's guidelines in both a DC mode and a pulsed mode.

Mathematical assumptions have been made to simplify derivations and provide useful formulae in simple terms; empirical data has verified that the resulting error is less than 5%.

Care should be taken in making use of the information presented. For example:

> A current pulse could be short enough to cause no apparent problem within the presented material. However, it could be of sufficient magnitude and duration to exceed the allowable current density of the bond wire interconnect causing it to fail.

## Thermal Parameters

The thermal behavior of a GaAs LED can be considered in a simple way by using the analogy of an electrical circuit. In this circuit, the heat power generator, the temperature differences, the thermal capacitors, and thermal resistors replace the conventional current or voltage generators, voltage differences, capacitors, and resistors respectively. Figure 1 shows this equivalent thermal circuit.

**Figure 1**—Equivalent Thermal Circuit

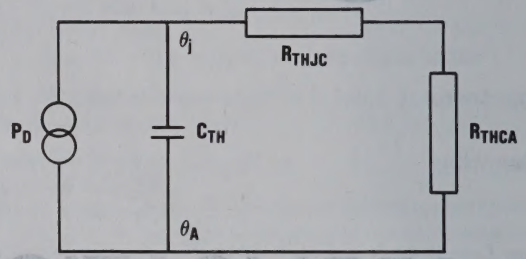



Table 1 defines the various thermal parameters we will be exploring in this bulletin.

Table 1
**Table 1** Thermal Parameters

| Symbol | Parameter | Units |
|---|---|---|
| $P_O$ | Output Power | W |
| $P_D$ | Dissipated power | W |
| $\theta_j$ | Junction Temperature | °C |
| $\theta_A$ | Ambient Temperature | °C |
| $C_{TH}$ | Thermal Capacitor | $Ws\,°C^{-1}$ |
| $R_{THJC}$ | Junction to Case Thermal Resistance | $°CW^{-1}$ |
| $R_{THCA}$ | Case to Ambient Air Thermal Resistance | $°CW^{-1}$ |
| $R_{THJA}$ | Junction to Ambient Air Thermal Resistance | $°CW^{-1}$ |
| $\tau_{TH}$ | Thermal Time Constant ($R_{THJA} \times C_{TH}$) | s |
| K | Thermal Rating Factor | None |
| $K_{eff}$ | Effective Duty cycle | None |

When forward current ($I_F$) flows through the GaAs LED, heat or power ($P_D$) is generated. Most of this heat is generated within:

(a) The upper section of the chip away from the mount area; the "N" area; the cathode.
(b) The mid section of the chip; the junction between the "N" and "P" regions.
(c) The lower section of the chip, the "P" area, the anode.

Heat is also generated in the contact interfaces and the conductors but this is considered negligible. This heat propagates through the chip and the mount surface primarily by thermal conduction. It is then transferred to the ambient air by thermal convection. All of the measurements and data presented in this bulletin were made with the air temperature in the room fairly constant throughout the test period and zero air velocity in the volume surrounding the device except for convection currents. Further, there were no extraneous thermal paths. Normal mounting of the devices in PC boards or adding heat sinks will improve the heat path. This is not considered in this bulletin with the exception of the last four (4) line items in Table 2. $R_{THJA}$ should be considered as $R_{THJX}$ in these cases. Table 2 lists several thermal parameters.

**Table 2** - Thermal Parameters of Optek GaAs LEDs

| GaAs LED Type | $R_{THJA}$ (°CW$^{-1}$) | $C_{TH}$ ($10^{-5}$Ws °C$^{-1}$) | $\tau_{TH}$ ($10^{-2}$s) | K |
|---|---|---|---|---|
| OP123/124, OP223/224 | 980 | 1.6 | 1.5 | 0.008 |
| OP131-133(W), OP231-233(W) | 490 | 3.0 | 1.5 | 0.008 |
| OP140/240 | 740 | 4.3 | 2.0 | 0.008 |
| OP160/260 | 740 | 5.3 | 3.9 | 0.008 |
| OP290/295 C, B, A | 188 | 1.4 | 0.3 | 0.008 |
| OP291/296 C, B, A | 188 | 1.4 | 0.3 | 0.008 |
| OP292/297 C, B, A | 188 | 1.4 | 0.3 | 0.008 |
| OP293/298 C, B, A | 500 | 4.0 | 1.5 | 0.008 |
| OPB706 (LED) | 700 | 5.2 | 3.6 | 0.008 |
| OP123/124, OP223/224[1] | 240 | 4.6 | 1.1 | 0.008 |
| OP123/124, OP223/224[2] | 400 | 4.5 | 1.8 | 0.008 |

(1) OP123/124 mounted on 0.062" double-sided PC board.
(2) OP123/124 mounted in OPB125/253 housing.

The first four (OP123 through OP136) GaAs LED's are all hermetic packages. The maximum allowable junction temperature is 125°C. See the example below for one use of Table 2.

(1) OP123/124 has $R_{THJA} = 980°CW^{-1}$

With $\Delta T_j = (125°C - 25°C) = 100°C$.

The maximum power that can be dissipated is:

$$P_{D(max)} = \frac{\Delta T_j}{R_{THJA}} = \frac{100°C}{980°CW^{-1}} = 102 \text{ mW}$$

The next three of the units listed are plastic packages. The maximum allowable junction temperature is 85°C.

OP140 has $R_{THJA} = 740°CW^{-1}$

With $\Delta T_j = (85°C - 25°C) = 60°C$

The maximum power that can be dissipated is:

$$P_{D(max)} = \frac{\Delta T_j}{R_{THJA}} = \frac{60°C}{740°CW^{-1}} = 81 \text{ mW}$$

The derating factor above 25°C can be readily calculated from this information.

(2) OP123/124

$$\text{Derating Factor} = \frac{\Delta P_D}{\Delta T_j} = \frac{102 \text{ mW}}{100°C} = 1.02 \text{ mW°C}^{-1}$$

OP140

$$\text{Derating Factor} = \frac{81 \text{ mW}}{60°C} = 1.35 \text{ mW°C}^{-1}$$

Most manufacturers will give more conservative deratings than these numbers. This is normally due to the devices being used in a quasi heat sink. For example, the OP123/124 is normally mounted in a double sided PC board. The OP140 is normally soldered into a PC board. This would improve the $R_{THJA}$ numbers. This becomes readily apparent by referring to the $R_{THJA}$ number of 980°CW$^{-1}$ for the OP123/124 in free air and the $R_{THJX}$ number of 240°CW$^{-1}$ when the units are mounted in a double sided PC board as shown in Table 2 or the 400°CW$^{-1}$ when they are mounted in the OPB700 or OPB701 housing. There is also a variation in $R_{THJA}$ brought about by a variation in the integrity of the thermal bond between the GaAs LED and the mount surface. This is not easy to measure and is not adaptable to 100% production testing.

## Temperature Response to a Thermal Power Step

A forward current step is introduced into a GaAs LED causing heat to be generated in the unit and causing the junction temperature to rise. The rise in junction temperature follows the formula shown below:

$$(3) \quad \theta_j(t) = \theta_A + P_D \times R_{THJA} \left(1 - e^{-\frac{t}{\tau_{TH}}}\right)$$

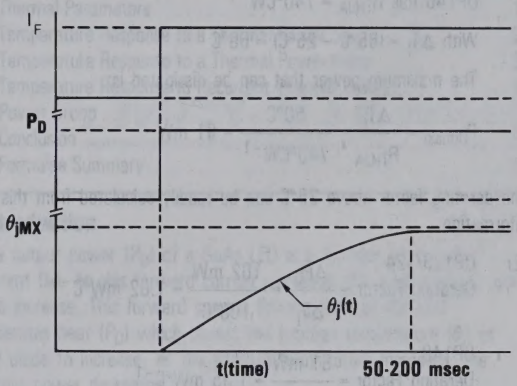
Where t is time in seconds
$P_D$ is dissipated power
$\tau_{TH}$ is thermal time constant
$R_{THJA}$ is junction to ambient air thermal resistance
$\theta_A$ is ambient temperature.

APPLICATION BULLETINS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

The junction temperature will approach its maximum value after $t = 5\ \tau_{TH}$ or 5 thermal time constants which approximates 50 to 200 milliseconds. Figure 2 shows the forward current step, the resulting power generated within the chip itself, and the rise in junction temperature versus time.

**Figure 2**—$I_F$, $P_D$, and Junction Temperature Versus Time




Practically, $P_D$ will decrease slightly as soon as the junction temperature of the chip starts to rise and will stabilize 50 to 200 milliseconds after the power is applied. This is discussed in more detail in the section on power droop.

At temperature equilibrium, the maximum junction temperature ($\theta_{jMX}$) is:

(4) $\theta_{jMX} = \theta_A + P_D^* \times R_{THJA}$

Where $P_D^* = V_F \times I_F$
$V_F$ = Forward Voltage @ $\theta_{jMX}$
$\theta_A$ = Ambient Temperature.
*For purpose of calculation, $P_D = P$ @ 25°C. The resulting error will have minor impact on the answer. Since $V_F$ decreases with increasing temperature, the resulting answers will be conservative.

**Example:** Using an OP133 which has a measured output of 5.3 mW @ $\theta_A$ = 25°C, calculated the output in a system where $I_F$ = 40 mA and $\theta_A$ = 50°C. The $I_F$ versus $P_O$ without heating is relatively linear above 5 mA.

$$P_O\ (40\ mA\ @\ 25°C) = P_O\ (100\ mA) \times 40/100$$
$$= 5.3\ mW \times 0.4$$
$$= 2.12\ mW$$

The power generated within the LED causing the junction temperature to rise is:

$$P_D = V_F \times I_F$$
$$= 1.5\ volts \times 0.04A$$
$$= 0.06\ watts$$

The final junction temperature is:

$$\theta_j = \theta_A + P_D R_{THJA}$$
$$= 50°C + (0.06 \times 490)$$
$$= 79.4°C$$

The output power of the OP133 is:

(5) $P_D(\theta_j) = P_D(25°C) \times e^{-K(\theta_j - 25°C)}$
$P_D(79.4°C) = 2.12 \times e^{-0.008(79.4 - 25)}$
$= 1.38\ mW$

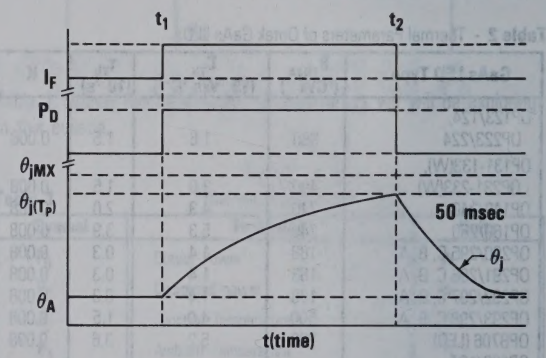
This constitutes a 35% decrease in output power from the 25°C level. The value of K was taken from Table 2.

## Temperature Response to a Thermal Power Pulse

A forward current pulse is introduced into a GaAs LED. This pulse is shorter than the 50 to 200 milliseconds required for the junction temperature to approach its highest value.

Figure 3 shows the relationship of the current pulse to the power pulse to the junction temperature versus time.

**Figure 3**—Current Pulse, Power Pulse, and $\theta_{j(T_p)}$ Versus Time




When $I_F$ begins to flow, the power generated within the LED causes $\theta_{j(t)}$ to follow the relationship:

$$(6)\quad \theta_{j(t)} = \theta_A + P_D R_{THJA}\left(1 - e^{-\frac{t}{\tau_{TH}}}\right) \qquad t_1 \le t \le t_2$$

When $I_F$ stops @ time $t_2$, the $P_D$ will stop and the junction temperature $\theta_j$ will start to decrease. This will follow the relationship:

$$(7)\quad \theta_{j(t)} = \theta_A + \left[P_D R_{THJA}\left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)\right]\left(e^{-\frac{t}{\tau_{TH}}}\right) \qquad t > t_2$$

**Example:** A single 1A pulse 100 sec wide is applied to an OP136. What will the junction temperature be at the end of the 100 $\mu$sec pulse?

$$\theta_{jMX}(100\ \mu sec) = \theta_A + P_D R_{THJA}\left(1 - e^{-\frac{t}{\tau_{TH}}}\right)$$

$$\theta_{jMX}(100\ \mu sec) = 25°C + (2V \times 1A) \times 470\left(1 - e^{-\frac{10^{-4}}{2 \times 10^{-2}}}\right)$$

$$= 25°C + 4.6°C = 29.6°C$$

Same as above except t = 1 msec

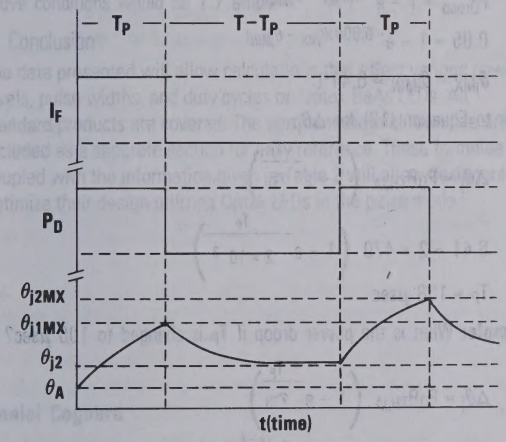
$$\theta_{jMX}(1\ msec) = 25°C + 2 \times 470\left(1 - e^{-\frac{10^{-3}}{2 \times 10^{-2}}}\right)$$

$$= 25°C + 45.5°C = 70.5°C$$

## Temperature Response to Recurrent Thermal Pulses

A forward current pulse is introduced into a GaAs LED. At some later time, the pulse is repeated. Figure 4 shows the relationship of $I_F$ to $P_D$ to $\theta_j$.

**Figure 4**—$I_F$, $P_D$, and $\theta_j$ Versus Time




The junction temperature $\theta_j$ rises during the first power pulse from $\theta_A$ to $\theta_{j1MX}$.

Refer to Equation (3).

$$\theta_{j1MX} = \theta_A + P_D R_{THJA}\left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)$$

The junction temperature $\theta_j$ decreases during the off time of the power pulse from $\theta_{j1MX}$ to $\theta_{j2}$.

Refer to Equation (7).

$$\theta_{j2} = \theta_A + \left[P_D R_{THJA}\left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)\right]\left(e^{-\frac{(T - T_P)}{\tau_{TH}}}\right)$$

During the second pulse, the junction temperature will rise from $\theta_{j2}$ to $\theta_{j2MX}$.

Refer to Equation (3), (6).

$$\theta_{j2MX} = \theta_{j2} + P_D R_{THJA}\left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)$$

After the second pulse is removed, the junction temperature will decrease to a new minimum temperature $\theta_{j3}$.

Refer to Equation (7).

$$\theta_{j3} = \left[\theta_{j2} + P_D R_{THJA}\left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)\right]\left(e^{-\frac{(T - T_P)}{\tau_{TH}}}\right)$$

This swinging movement of $\theta_j$ goes on and on with $\theta_{jMX(n)}$ and $\theta_{j(n)}$ gradually rising to a stabilized value. At the end of the $n^{th}$ pulse, the junction temperature is $\theta_{jn}MX$.

$$(8)\quad \theta_{jnMX} = \theta_A + \left[P_D R_{THJA}\left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)\right] \times \left[\sum_{i=0}^{i=n-1}\left(e^{-\frac{(T - T_P)}{\tau_{TH}}}\right)\right]$$

When the temperature stabilization point is finally reached, the $\theta_{jMX}$ becomes:

$$(9)\quad \theta_{jMX} = \theta_A + P_D R_{THJA}\left(\frac{1 - e^{-\frac{T_P}{\tau_{TH}}}}{1 - e^{-\frac{T_P}{\tau_{TH}\left(\frac{n}{1-n}\right)}}}\right)$$

Where $n = \frac{T_P}{T}$ or duty cycle

For small values of (n), the equation simplifies to:

$$(10)\quad \theta_{jMX} = \theta_A + P_D R_{THJA} K_{eff}$$

Where $K_{eff} = \dfrac{1 - e^{-\frac{T_P}{\tau_{TH}}}}{1 - e^{-\frac{T_P}{n\tau_{TH}}}}$ = effective duty cycle

The minimum junction temperature becomes:

$$(11)\quad \theta_{jMIN} = \theta_A + P_D R_{THJA} K_{eff}\left(e^{-\frac{T_P}{n\tau_{TH}}}\right)$$

The delta temperature or the difference between $\theta_{jMX}$ and $\theta_{jMIN}$ becomes:

$$(12)\quad \Delta\theta_j = \theta_{jMX} - \theta_{jMIN}$$

$$\Delta\theta_j = P_D R_{THJA} K_{eff}\left(1 - e^{-\frac{T_P}{n\tau_{TH}}}\right)$$

$$= P_D R_{THJA}\left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)$$

APPLICATION BULLETINS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

**Example:** An OP136 is operated at $I_F$ = 1A, n = 1%, $T_P$ = 100 μsec. What is $\theta_{jMX}$? $\theta_{jMIN}$? $\Delta\theta_j$?

OP136 $R_{THJA}$ = 470°CW$^{-1}$

$P_D$ = 1A × 2V = 2W

$$K_{eff} = \frac{1 - e^{-\frac{10^{-4}}{2 \times 10^{-2}}}}{1 - e^{-\frac{10^{-4}}{2 \times 10^{-4}}}} = 1.26 \times 10^{-2}$$

Refer to Equation (10).

$$\theta_{jMX} = 25°C + (2 \times 470 \times 1.26 \times 10^{-2}) = 36.7°C$$

Refer to Equation (11).

$$\theta_{jMIN} = 25°C + (2 \times 470 \times 1.26 \times 10^{-2}) \left(e^{-\frac{10^{-4}}{2 \times 10^{-4}}}\right)$$
$$= 32.1°C$$

Refer to Equation (12).

$$\Delta\theta_j = 36.7° - 32.1 = 4.6°C$$

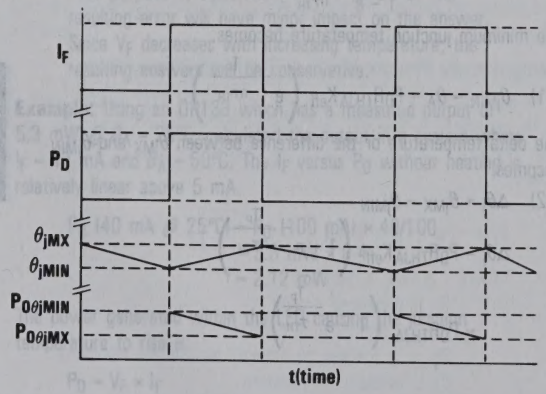
Verifying, refer to Equation (12).

$$\Delta\theta_j = 2 \times 470 \left(1 - e^{-\frac{10^{-4}}{2 \times 10^{-2}}}\right)$$
$$= 4.6°C$$

## Power Droop

The junction temperature of an LED will oscillate between $\theta_{jMX}$ and $\theta_{jMIN}$ under recurrent pulses after the pulses have been on for a period of time. The radiant power output ($P_O$) will decrease during the "ON" time as the junction temperature rises from $\theta_{jMIN}$ to $\theta_{jMX}$. This is shown in Figure 5 and is called power droop.

**Figure 5–** $I_F$, $P_D$, and $\theta_j$, and $P_O$ Versus Time




This decrease in power out or power droop during the "ON" cycle is dependent on $\theta_{jMX}$ and $\theta_{jMIN}$. Most systems desire this droop to be kept below 5-10% in order to limit the influence on system operation. The major factors that control this are the forward current ($I_F$), forward voltage drop ($V_F$), pulse duration ($T_P$), duty cycle (n), and thermal resistance ($R_{THJA}$).

$$P_O(\theta_{jMIN}) = P_O(25°C) \times e^{-K(\theta_{jMIN} - 25°C)}$$

$$P_O(\theta_{jMX}) = P_O(25°C) \times e^{-K(\theta_{jMX} - 25°C)}$$

By definition, the power droop is:

$$P_{Droop} = \frac{P_O(\theta_{jMIN}) - P_O(\theta_{jMX})}{P_O(\theta_{jMIN})}$$

(13) $$P_{Droop} = 1 - e^{-K(\theta_{jMX} - \theta_{jMIN})}$$

**Example:** An OP136 is being operated at $I_F$ = 1A and n = 1%. What is the maximum pulse width for a droop of 5%?

$$P_{Droop} = 1 - e^{-K(\theta_{jMX} - \theta_{jMIN})}$$

$$0.05 = 1 - e^{-0.008(\theta_{jMX} - \theta_{jMIN})}$$

$$\theta_{jMX} - \theta_{jMIN} = 6.41°C$$

Refer to Equation (12) for $\Delta\theta_j$.

$$\Delta\theta_j = P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)$$

$$6.41 = 2 \times 470 \left(1 - e^{-\frac{T_P}{2 \times 10^{-2}}}\right)$$

$$T_P = 138\ \mu sec$$

**Example:** What is the power droop if $T_P$ is changed to 100 μsec?

$$\Delta\theta_j = P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)$$
$$= 2 \times 470 \left(1 - e^{-\frac{10^{-4}}{2 \times 10^{-2}}}\right)$$
$$= 4.6°C$$

$$P_{Droop} = 1 - e^{-0.008(4.6°C)}$$
$$= 3.6\%$$

**Example:** What is the power droop on the OP133 under the same conditions as the OP136?

$I_F$ = 1A, n = 1%, $T_P$ = 100 μsec

$$\Delta\theta_j = P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)$$
$$= (1A \times 2.5\ V) \times 490 \left(1 - e^{-\frac{10^{-4}}{1.5 \times 10^{-2}}}\right)$$
$$= 8.07$$

$$P_{Droop} = 1 - e^{-0.008(8.07)}$$

$$P_{Droop} = 0.0625 = 6.25\%$$

**Example:** What is the maximum power that can be dissipated in the OPB950 when $T_P$ is 20 $\mu$sec, duty cycle is 1%, and droop is restricted to 5% maximum?

$$P_{Droop} = 1 - e^{-K(\theta_{jMX} - \theta_{jMIN})}$$

$$0.05 = 1 - e^{-0.008(\theta_{jMX} - \theta_{jMIN})}$$

$$(\theta_{jMX} - \theta_{jMIN}) = 6.41°C$$

$$\Delta\theta_j = P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)$$

$$6.41 = P_D \times 250 \left(1 - e^{-\frac{20 \times 10^{-6}}{3.24 \times 10^{-3}}}\right)$$

$$P_D = 4.23$$

With a $V_F$ of approximately 2.5 volts, the maximum $I_F$ under the above conditions would be 1.7 amps.

## 7. Conclusion

The data presented will allow calculations that effect various power levels, pulse widths, and duty cycles on Optek GaAs LEDs. All standard products are covered. The pertinent thermal formulae are included as a separate section for easy reference. These formulae coupled with the information given in Table 2 will allow designers to optimize their design utilizing Optek LEDs in the pulse mode.

**Daniel Cognard**

**William Nunley**

## 8. Thermal Formulae

1. Maximum Power Dissipation

$$P_{D(MAX)} = \frac{T_j}{R_{THJA}}$$

2. Derating Factor

$$\frac{\Delta P_D}{\Delta T_j}$$

3. Effective Duty Cycle
(Square current pulses)

$$K_{eff} = \frac{1 - e^{-\frac{T_P}{\tau_{TH}}}}{1 - e^{-\frac{T_P}{n\tau_{TH}}}}$$

4. Maximum Junction Temperature
(Repetitive Pulses)

$$\theta_{jMX} = \theta_A + P_D R_{THJA} K_{eff}$$

5. Minimum Junction Temperature
(Repetitive Pulses)

$$\theta_{jMIN} = \theta_A + P_D R_{THJA} K_{eff} \left(e^{-\frac{T_P}{n\tau_{TH}}}\right)$$

6. Junction Temperature Swing

$$\Delta\theta_j = P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)$$

7. Power Droop

$$P_{Droop} = 1 - e^{-0.008(\Delta\theta_j)}$$



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

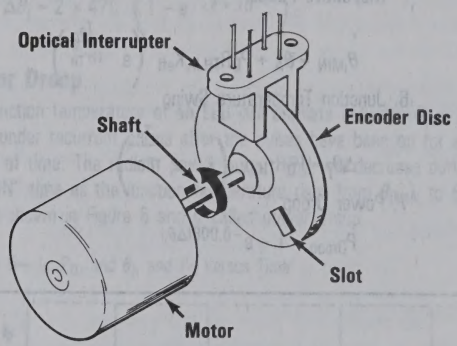
# Motion sensing with optical interrupters—selecting the proper sensor for optimum system design.

This application bulletin will discuss many of the variables associated with single channel encoding. This will include design considerations for using both non-apertured and apertured transistors or Photologic™ output devices. Refer to application bulletins 203 and 206 for additional information.

## General Discussion

The most common application of optoelectronics is the sensing of motion with an optical interrupter. The normal single channel optical interrupter module consists of an emitter or energy source and a receiver or energy sensor separated by a slot or air gap. The interruption of this beam causes an on/off signal from the sensor. When the energy path is blocked, the sensor will be "off" allowing only leakage current to flow. When the energy path is open, the sensor will be "on," causing significantly higher currents to flow. This is often accomplished by placing a rotating plate (or encoder disc) in the slot between the LED and energy sensor as shown in Figure 1.

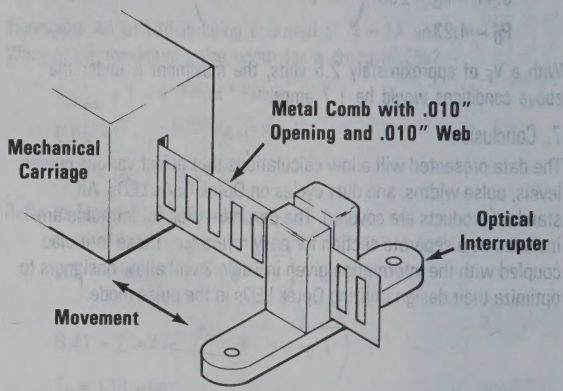
**Figure 1** – Tachometer or Motor Speed Monitor




There is usually an opening or slot in the encoder disc that allows the photosensor to be exposed to energy from the LED once each revolution. The energy through the slot will cause the sensor to turn "on" when the slot is present and turn "off" after the slot goes by. This energy pulse will relate the mechanical motion of the encoder disc to the electrical signal by giving one pulse per revolution. By counting these pulses for a given time interval, the speed of rotation may be determined. This gives rise to the "Tachometer" or motor speed monitor.

This encoder disc may be replaced with a fence or comb that passes through the same slot. The same logic presented for the encoder disc will hold true. One electrical pulse is formed for each opening in the fence or comb that passes the LED/sensor pair. Thus the linear motion of the fence or comb can be related to an electrical series of pulses. Figure 2 shows this mechanical system pictorially.

**Figure 2** – Linear Encoder Relating Distance Versus Pulses

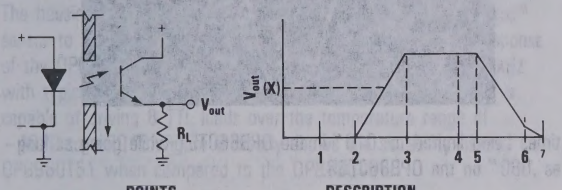



Analysis of the use of an optical interrupter module for a specific application requires several considerations to be analyzed. Most design engineers consider cost, functionality, and reliability as goals in their design. Most important, however, is total application performance. The part must be designed so that minimum support is required in a production type environment. This production environment begins with the fabrication of the basic design and continues through the design performance in subsequent sub-assemblies until the final product is complete. The design is considered successful if, once implementation is complete, the system runs so smoothly, the designer receives no negative feedback. This requires "luck" or a systematic approach to understanding and consideration of all major variables. This application bulletin will use a tachometer design as the mechanism to apply the philosophy of "the successful designer approach."

## Non-apertured Encoding

Most tachometer applications require a digital signal which can be easily processed to determine the speed at which a mechanical motion is taking place. There are several variables that need to be discussed that control this digital signal. Figure 3 pictorially represents the general wave shape that will appear across the load resistor as the slot goes by the sensor.

**Figure 3** – Pictorial Representation of Signal Pulse




| | POINTS | DESCRIPTION |
|---|---|---|
| Turn on delay time | 1 | Sensor starts to be uncovered |
| Gain + turn on time | 2 | Sensor starts to turn "on" |
| Slot Width | 3 | Sensor reaches maximum turn "on" or saturation |
| Turn off delay time | 4 | Sensor starts to be covered |
| | 5 | Sensor starts to turn "off" |
| Turn off time | 6 | Sensor is completely covered |
| | 7 | Sensor output of signal current decreases to leakage |

As the slot starts to open up the energy path between the sensor and the LED, the sensor will start to turn "on." If the system has adequate gain, the sensor will saturate prior to the trailing edge of the slot reaching the leading edge of the sensor. The signal level will diminish as the slot goes by reducing the energy level to the sensor.

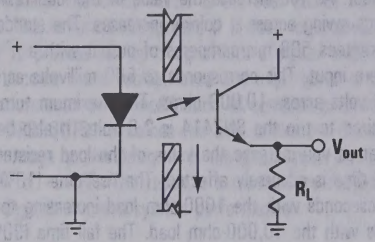
This time interval from 1 through 7 will remain fairly consistent for a given setup. As different units from various production runs are substituted, the main variations that will be viewed are:

a. Variations in slope between 2 and 3
b. Variations in slope between 5 and 7

As the system gain increases, the turn on time will decrease and the flat portion between 3 and 5 will get wider. In other words, 3 will move to the left and 5 will move to the right. The turn on delay will decrease slightly, moving 2 to the left. The point labeled 7 will move to the right showing the sensor turn off time has increased. This will cause the voltage reading at point 6 to increase. As the system gain decreases, the inverse will happen. Points 3, 4, and 5 will become one point and start to decrease. Points 1 and 6 never move. If the circuit is desired to turn on or off at level "X," the "X" will move as these slopes change.

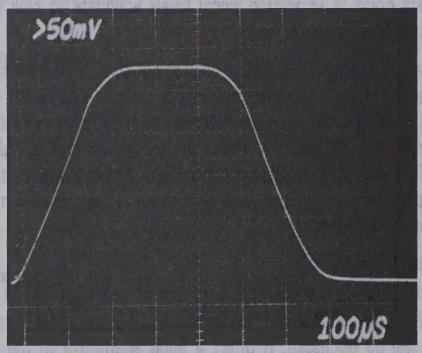
The OPB860T55 is a commercially available optical interrupter from Optek Technology. It has no built-in aperture. It will be used as an example for the discussion of the choice of a specified load resistor. Figure 4 shows a typical circuit where $V_{out}$ will drive the input of a TTL gate such as the SN7414 Schmitt trigger.

**Figure 4** – Optical Beam Interrupter

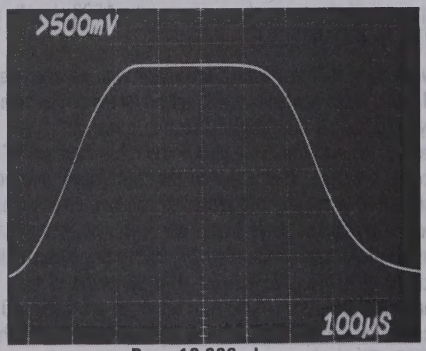



The choice of this load resistor is usually the first parameter the design engineer must consider. The end result is a TTL compatible analog voltage generated across this load resistor. The minimum allowed on-state current and the maximum allowed off-state current of the OPB860T55 become the first two restrictions on the choice of this load resistor. In order to be able to generate a reliable digital output, the system must guarantee the analog voltage will swing above and below the positive and negative going thresholds, respectively, of the TTL gate. Figure 5 shows the output of the OPB860T55 with the resistive load of 1000 ohms, and 10,000 ohms.

**Figure 5** – OPB860T55 Output Versus $R_L$




**$R_L$ = 1000 ohms**




**$R_L$ = 10,000 ohms**

APPLICATION BULLETINS

A study of these photographs will quickly show a positive and a negative aspect. As you increase the value of the load resistor, the analog voltage swing across it quickly increases. The standard product guarantees 500 microamperes of output with a 20-milliampere input. This corresponds to 500 millivolts across 1000 ohms and 5 volts across 10,000 ohms. The maximum turn on voltage required to trip the SN7414 is 2.0 volts. It also becomes apparent that as you increase the value of the load resistance, the rise and fall time is adversely affected. The rise time (10% to 90%) is 160 microseconds with the 1000-ohm load increasing to 180 microseconds with the 10,000-ohm load. The fall time (90% to 10%) is 170 microseconds with the 1000-ohm load increasing to 200 microseconds with the 10,000-ohm load. The frequency response is significantly decreased with increased load resistance. Keep in mind that the measured rise times and fall times are a combination of the electrical rise and fall time of the sensor as well as the mechanical rise and fall time of the system. The sensor gradually is exposed to the light as it is uncovered and the light is gradually removed as it is covered. This increase in load resistance may lead to a secondary problem.

As the magnitude of the load resistor is increased, greater care must be taken in the mechanical design to prevent off-state problems. This means guarding against spurious light signals that may create noise or unwanted signal levels adequate to give a signal pulse when none is there.

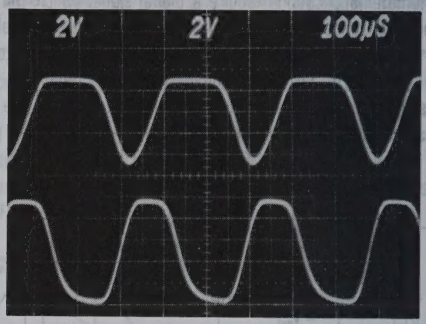
Two other options become potential problem solvers. Increasing the LED drive current will increase the output current. Care must be taken as increasing the drive current will also decrease reliability. The supplier may be asked to select units that will give a higher output. This will increase the cost in inverse proportion to the amount of units meeting the new requirements that lie within the production distribution.

## Apertured Encoding

The OPB860 series are available with sensor apertures of .010" and .050". The OPB860T51 which has a .010" × .040" sensor aperture will be discussed. It offers a good alternative to the OPB860T55 when resolution becomes more critical. Figure 6 shows the comparison of the wave shapes across the 1000-ohm $R_L$ of the OPB860T55 and OPB860T51.

The waveforms shown in Figure 6 are made with an apertured disc that had .025" openings and .038" opaque areas for its total periphery. This causes the OPB860T55 (top trace) not to go completely to ground potential which is the cross hatched "x" line on the scope faceplate. This is due to the "light bleed" around the .038" opaque area causing the sensor to continue conduction. This would not be present in single pulses per revolution. Minimization of the "light bleeding" can be obtained by making the encoder disc (50% opaque-50% open) 25% larger than the width of the sensor aperture. The turn on and turn off times are about 60 microseconds for the OPB860T51 and 80 microseconds for the OPB860T55. This is due to the mechanical turn on and turn off

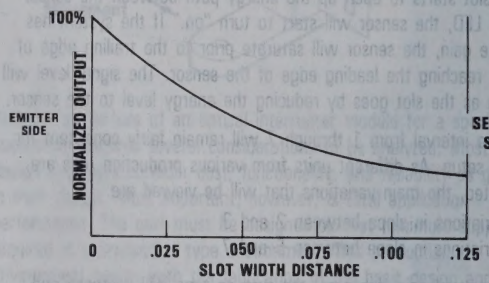
**Figure 6** – OPB860T55 (upper) Versus OPB860T51 (lower)




times being limited to .010" in the OPB860T51 while going as long as .060" on the OPB860T55.

In addition, it is important to keep the encoder disc as close to the sensor as possible to further decrease "light bleeding." Note that the output level of the sensor in an individual unit will decrease as the encoder wheel moves laterally from the LED or emitter side toward the sensor side of the unit. This is shown in Figure 7.

**Figure 7** – Normalized Sensor Output Versus Lateral Slot Opening




This is brought about because the energy from the LED is not collimated and does not have a point source radiation pattern. In addition to the encoder position relative to the sensor, the effect can be minimized by minimizing wobble of the encoder wheel within the interrupter slot. In more complex applications where much greater resolution is needed, i.e., the width of the LED and sensor apertures are decreased to the point that energy from the LED cannot be detected by the sensor, the use of a multi-slotted aperture called a reticle with a pattern identical to the encoder disk is used. (See Application Bulletin 206 for more information.) The effect is a shuttering of light. It allows more energy to be sensed by the sensor while maintaining high resolution.

Another solution to the higher resolution requirements is to use Photologic™. This improves timing accuracy when it is not convenient to have amplification circuitry in close physical proximity

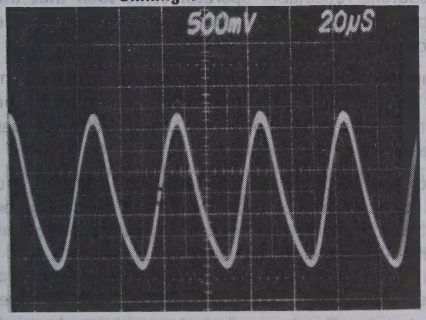
to the optical interrupter module. This amplification guards against noise causing spurious signals which could upset system performance.

## Apertured Function Encoding

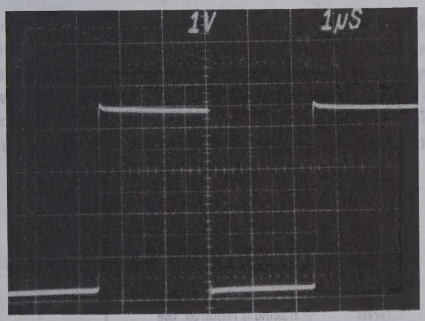
The solution to the problems presented before is a sensor function. The OPB960T51 is similar in appearance to the OPB860T51. It requires three leads for the sensor rather than two leads. The sensor function is a Photologic™ chip consisting of a photo sensitive element and a Schmitt trigger buffer integrated on a common chip. The housing contains a .010" aperture in front of the Photologic™ sensor to allow for high resolution encoding. The frequency response of the OPB960T51 is improved over the OPB860T51 to 250 kHz with typical rise and fall times of 70 nanoseconds. The output is capable of driving 8 TTL loads over the temperature range of −40 °C to +70 °C. Figure 8 clearly shows the suitability of the OPB960T51 when compared to the OPB860T51.

**Figure 8**

**OPB860T51 @ 25 kHz**
**Sinking 1 TTL Load**




**OPB960T51 @ 200 kHz**
**Sinking 8 TTL Loads**




As long as the required frequency response is slow enough and the output is adequate, the OPB860T51 is the best choice from a system cost. This is further supported if unused logic gates exist for the designer to process the opto signal into a digital output. As the applications become more sophisticated and importance is shifted to improved performance and simplification of complex processing circuits, the OPB960T51 becomes the best choice for the designer. A major advantage to the designer is the guaranteed performance from −40 °C to +70 °C. The result is a much more reliable design in terms of degradation and system performance.

## Conclusion

The OPB860T55 (non-apertured optical interrupter) will perform quite reliably in low speed, low resolution encoding. The OPB860 family offers an improvement in resolution. The narrow aperture offers superior resolution in linear encoders. The OPB960T51 is the choice where higher output levels, speed, and precise resolution are required.

Refer to Application Bulletins 203 and 206 for additional information.

**THOMAS W. SWARD**

**WILLIAM NUNLEY**

APPLICATION BULLETINS

OPTEK

# Soldering to semiconductor leads — a supplement to manufacturer's specifications.

Normal lead soldering information furnished on semiconductor product data sheets is limited to the maximum temperature, the maximum time at this temperature and the minimum distance from the temperature to the case of the unit. This bulletin discusses some of the aspects of soldering using an iron, a pot, or a flow bath. This will involve discussions of both hermetic or metal packaged parts and plastic encapsulated parts.

## GENERAL DISCUSSION

A variety of different methods are used to make a solder joint between a semiconductor product and the circuit to which it is wired. Care and expertise are required to minimize unit loss and maximize unit yield. A few technique improvements, and suggestions as to proper solder and flux selections are discussed. Familiarization with the points brought out in this bulletin will assist the user to minimize solder problems.

## PERFORMANCE CHARACTERISTICS

A typical data sheet will have the following information in the absolute maximum ratings:

Lead Soldering Temperature . . . . . 240°C
(1/16 inch from case for 3 seconds)

These conditions except for "time" are readily controlled in flow soldering and solder pot applications. It becomes difficult to control the maximum temperature in solder iron applications. The normal solder used is 60/40 lead tin which softens at 180°C and flows at 220°C. If the temperature of the iron or the time it is in contact with the solder lead interface is not controlled, the 240°C can be significantly exceeded. Several techniques or controls are helpful in preventing this overheating.

1. Limiting the maximum temperature of the iron by controlling the power to the iron. The slower the operator is, the cooler the iron should be.
2. Careful selection of proper solder, flux, iron, tip and surface preparation can minimize problems.
3. Verbal explanation, knowledgeable tutoring and assistance, and pictorial examples can also be helpful.
4. Proper design of the work station to minimize fatigue and encourage repeatable operator steps such that the solder operation is done in the same sequence by the same motions.
5. Once the technique is learned, it is very important to encourage speed. Normally, the higher the output, the higher the quality level once the basic technique has been mastered.
6. Design of the PC board land patterns with the unit and method of soldering of uppermost importance can be of significant help. The subsequent discussion on soldering of the pill package will illustrate this.

Table 1 lists the solder, flux, dwell times and distances recommended by Optek on their hermetic and plastic encapsulated components.

**TABLE I** – Soldering Components Listing

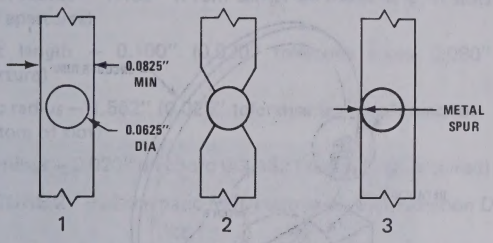
| PACKAGE | TYPE OF SOLDER | TYPE OF FLUX | MAX DWELL TIME | DISTANCE FROM CASE | COMMENTS |
|---|---|---|---|---|---|
| **Flow Soldering** | | | | | |
| Hermetic | 63/37 Tin Lead Bar | Active Rosin foaming flux (Kester 197 is suitable) | 10 Sec | 1/16" | Except for "pill" packages |
| Plastic | 63/37 Tin Lead Bar | | 10 Sec | 1/16" | |
| **Solder Pot** | | | | | |
| Hermetic | 63/37 Tin Lead Bar | Kester 1544 is suitable | 10 Sec | 1/16" | Use water white rosin flux on pills (Alpha 100 is suitable) |
| Plastic | 63/37 Tin Lead Bar | | 10 Sec | 1/16" | |
| **Solder Iron** | | | | | |
| Hermetic | 60/40 Tin Lead Wire Rosin Core, as small a diameter as possible | | 3 Sec | 1/16" | If fluxing is required, use mildly activated rosin flux dispensed from hypodermic needle. Kester 1544 is suitable. |
| Plastic | | | 3 Sec | 1/16" | |

All rosin flux residue can be removed with isopropyl alcohol and water rinses. (All recommended fluxes are rosin base.)

The pill package (OP 600—OP 123 types) requires more care than any other package. The unit is designed for solder contact on either side of a PC board by any of the three techniques. It is not normally flow soldered since two passes must be made through the machine, and tooling can be complicated. Care must be taken in the PC board design to prevent subsequent problems. The mounting hole should be drilled to 0.0625" ±0.001". The following should be considered when designing the land area for the lens side of the device:

**FIGURE I**

PC Land Pattern Design




1. If space permits, allow a minimum of 0.010" on either side of mounting holes.
2. Design with cutaways when lands are narrow or consistent orientation of tabs is desired.
3. Hole off center with narrow lands will create fingers of land pattern due to "undercut" that may short the unit as the package is inserted into the hole.

The two desirable factors are: To have as much surface area of land pattern adjacent to the unit as possible to ensure support of both lens mounting tabs to prevent tilting, and to provide mechanical strength of land pattern when unit is being reworked or removed.

## HAND SOLDERING

Once the packages are inserted into the PC board, the board should be turned so lens side is down and resting on a hard rubber or similar surface that will prevent damage to the glass lens but firmly support it. The operator will then press firmly down on the board with one hand. The iron is held in the other hand with the tip resting on the land pattern approximately 1/4" from the unit. The tip is slowly moved toward the unit; while watching the land pattern melt ahead of the tip. The speed of travel is as fast as the operator can handle the movement comfortably ensuring the land pattern melts. At the time the tip reaches the unit, solder is fed by the hand resting on the board without removing the downward pressure. The iron is wiped around the unit at the same rate of travel as was used on the land pattern. Once the 360° circle is complete, the solder wire is removed. The operator may make another 360° turn with the iron. Experience will show the best way. After all the plug sides are soldered, the board will be inverted and the lens tabs will be soldered to the two land patterns. The same technique is used except omit the 360° circle. The tabs are soldered in two operations.

## SOLDER POT or DIP SOLDERING

A popular method of soldering pills in PC boards, when the design permits, is dip soldering or immersing the pill in the PC board in molten solder. The following conditions called out in Table II should be used.

**TABLE II** – Dip Soldering

| | |
|---|---|
| Temperature of solder | 230°C ±5°C |
| Insertion or retraction rate | 0.25 inches/second |
| Dwell Time | 3—5 seconds |
| Flux | "R" type (non-activated) |
| Flux Dilution | Methanol |

CAUTION: After removing from the solder pot, the unit should be held still until the solder has hardened. Vertical insertion and removal with minimum lateral movement is required for minimum problems (inadequate coverage or shorts). There should be a minimum of 0.025" clearance between lands to prevent bridging.

All solder joints on all other packages in 0.062" PC boards should be soldered on the side away from the component. This guarantees the minimum distance of 1/16" from device to heat source. On open air solder joints, a pair of long nose pliers or some other heat sink gripping the lead between the joint and the unit can prevent problems. By following the information given above and exercising good judgement and common sense, the user will encounter very few problems related to solder joints on Optek components.

**WILLIAM NUNLEY**

**HOWARD BROWN**



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# TWO CHANNEL OPTICAL INTERRUPTERS MAY BE USED FOR DETERMINING DIRECTION OF ROTATION, SPEED, AND THE RELATIVE LOCATION OF A ROTATING SHAFT

Optek has two types of dual channel optical interrupters available. The OPB 822 family has two side-by-side channels on 0.212" centers and the OPB 826 family has two vertical channels on 0.150" centers. These standard parts may be used for determining direction of rotation, speed, and relative location of a rotating shaft. This bulletin will discuss some of the design aspects of two channel encoding along with circuit concepts and unit performance.

## GENERAL DISCUSSION

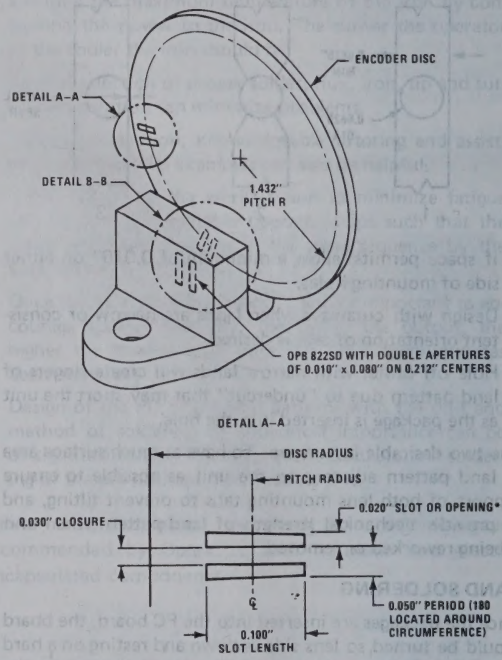
Rotational direction of a shaft can be readily determined by utilizing the two channels of an optical interrupter, an encoder disc with a number of openings around the circumference, and some simple electronics. The speed and relative shaft location information is available as a by-product and requires some additional electronics.

Figure 1 is a pictorial definition of terms used in this bulletin and should be referred to for clarification. A period is defined as 360 electrical degrees or the mechanical width of one opening plus one closure at the central point of the slot near the circumference of the encoder disc. When using a vertical, dual-channel unit, the outer row of periods are normally offset by 90 electrical degrees, or 1/4 period, from the inner row of periods. This will cause one channel to turn on approximately 90 electrical degrees ahead of the other as a function of rotation. In shaft encoding terminology, quadrature is the term defining determination of rotational direction by the phase relationship between the outputs of the two channels. System design normally uses 90° for this phase shift. Speed can be determined by accumulating the number of signal pulses for a fixed period of time, dividing by the number of periods per revolution thus obtaining the revolutions for this time period. Relative location is determined by dividing 360 by the number of periods around the circumference. A pulse is generated for each of these rotational segments. Counters may be used to relate a certain number of pulses to a desired action. This bulletin will describe the method of obtaining the three pieces of information (rotation direction, speed, and relative location) rather than what is done with the information.

## PERFORMANCE CHARACTERISTICS

The OPB 822SD is used as the demonstration interrupter to describe method and operation. Apertures (0.010" x 0.080") are mounted in front of both sensors and LED's. The 0.010" dimension is perpendicular to the rotational vector of the encoder disc at the slot between the sensor and LED. A system is desired with 2° mechanical resolution of rotational movement, thus 360°/2 or 180 cycles or periods around the circumference. Each cycle or period corresponds to an opening and a closure in the encoder disc passing a sensor and LED combination.

**FIGURE 1**
Pictorial Definition of Terms




* The sides of the slots lie on the extension of the two radii that are 1.432" long and 0.020" apart at the chord that defines the width of the center of the slot. The contained ∠ at that point is 0.8°.

An off-multiple of periods between the center line of the sensor apertures (0.212") is required for the 90° phase shift. This off-multiple can be 1/4, 3/4, 1-1/4, 1-3/4, 2-1/4, 2-3/4 etc. periods. For example, a period of 0.050" will yield 4-1/4 cycles or periods in the 0.212" distance between these apertures.* The radius of the encoder disc is determined to be 1.432". (0.050" period x 180 periods per revolution x 1/2 $\pi$ = radius). The opening in the disc should not be less than 0.010" as this would decrease the guaranteed output signal. A good rule for designing encoders is to keep the ratio of the opening to the closure at 2/3's. The disc can now be specified as:

Pitch radius – 1.432" (From center of wheel to ℄ of slots and apertures)

Slot length – 0.100" (0.020" tolerance above 0.080" aperture)

Disc radius – 1.562" (0.025" tolerance between disc and bottom of slot)

Openings – 0.020" on chord @ 1.432" radius (180 required)

Closure – 0.030" on chord @ 1.432" radius (180 required)

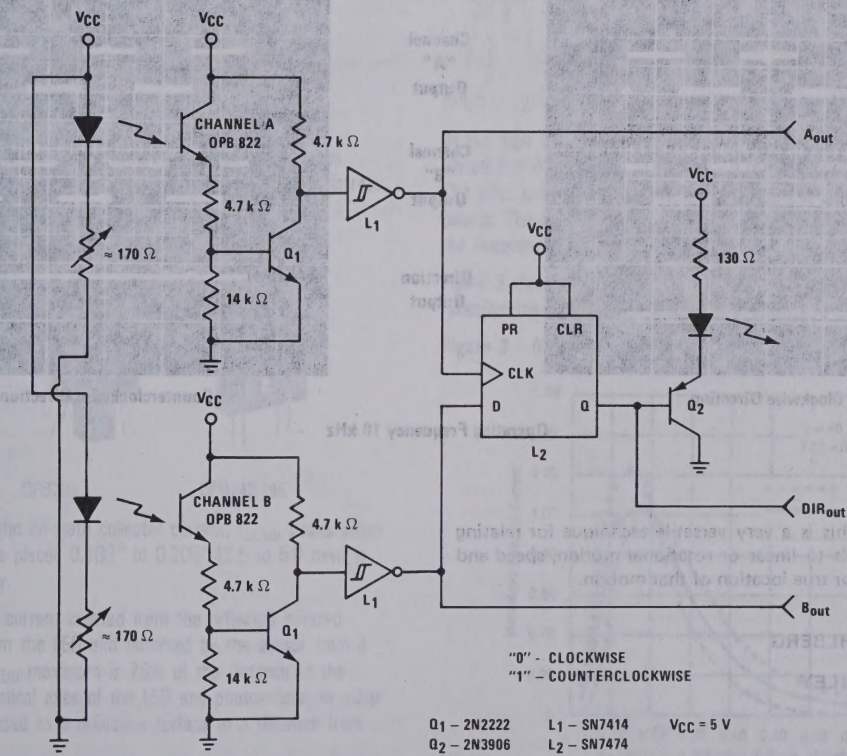
Disc material and thickness – Polycarbonate plastic, 0.060" thick

Crosstalk will not occur due to the narrow apertures (0.010") on both sensor and LED. This disc was then paired with the circuit shown in Figure 2.

* $\frac{0.212}{\text{off-multiple}}$ x mechanical resolution (pulses/revolution) x 1/2 $\pi$ = pitch radius.

As shown in Figure 2, channel "B" provides the "D" input and channel "A" provides the "clock" input to the SN7414. (The SN7414 converts the relatively slow transitions from the mechanical motion to TTL compatible rise and fall times.) Since channel "A" clocks the latch at its positive transition, the state of channel "B" at "D" determines the state of the latch. If the "Q" output of the latch is high (1 state) then the "D" input was high when channel "A" turned "ON". Thus channel "B" turned "ON" prior to channel "A". This implies counterclockwise direction of

**FIGURE 2** – Schematic for Determination of Rotation Direction, Relative Position and Speed





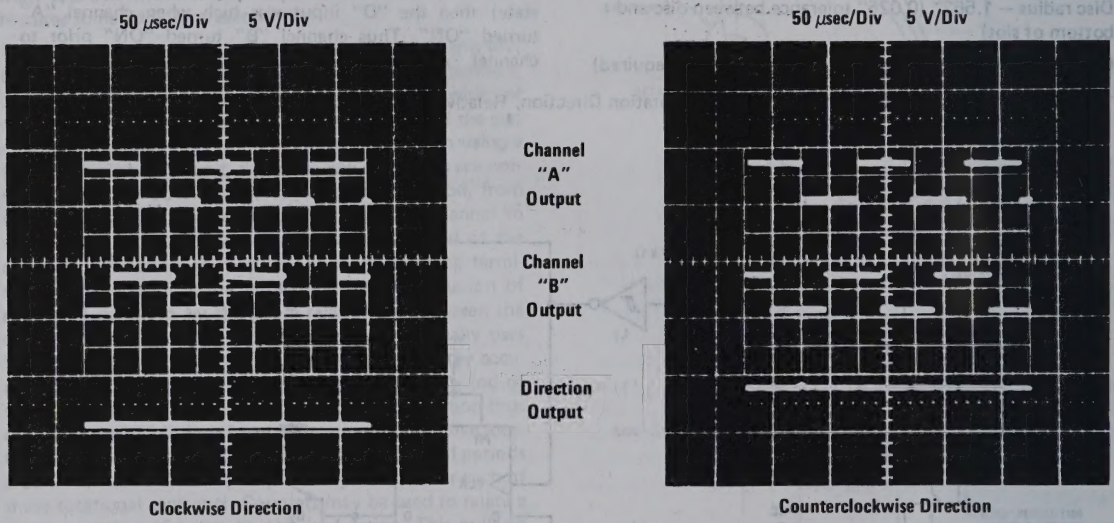

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

rotation. For clockwise rotation, channel "A" turns on prior to channel "B" and the "Q" output of the latch will be low (0 state). The pulses at A out or B out may be used for speed and/or relative location. Speed may be determined by counting the output pulses for a given time period and dividing the total count by 180 (pulses per revolution). Relative event location may be controlled within approximate 2° accuracy($\frac{360°}{180}$) by specifying the number of pulses between related events. For example, 45 pulses would correspond to 1/4 rotation or 90 mechanical rotational degrees.

The photographs shown in Figure 3 demonstrate the "0" and "1" level for clockwise and counterclockwise rotation.

The left photograph shows a "0" level denoting clockwise rotation. The right photograph shows the opposite. Additional circuitry may be added using the time base pulses already present. If a third interrupter channel were added that could relate back to a fixed location of the shaft, then the relative location could be changed to true location. This might become the left margin control, right margin control and/or index for next line control. All of these functions could be performed quite easily. The same technique may be used in linear motion where the encoder disc is replaced by a comb with a series of openings and closures. The direction of movement, speed, and the relative location of the comb could be used as discussed before by molding the comb with the openings 0.020" wide by 0.100" high every 0.050" length along the comb.

**FIGURE 3**




## CONCLUSION

In summary, this is a very versatile technique for relating electrical signals to linear or rotational motion, speed and either relative or true location of that motion.

RICHARD DAHLBERG

WILLIAM NUNLEY

OPTEK

# Reflective Assemblies – Design considerations for single-sided sensing applications.

## General Discussion

A reflective assembly generally consists of a single emitter and sensor in the same housing. This provides a major mounting advantage because optical access to the surface to be sensed is required from only one side. However, this can lead to a wide variety of design variables involving mounting configurations, reflective surfaces, and sensing circuits.

Designers are often faced with conditions that prevent reflective assemblies from being used as specified by the manufacturer. Reflective surfaces may be different than specified, or the gap between the assembly and the reflective surface may be greater or less than specified and/or cannot be consistently maintained. The mounting requirements may make tight control impractical and/or the "contrast ratio"[1] may have to be improved.

Optek offers several reflective assemblies providing the designer with alternative solutions to these problems.

## Performance Characteristics

Optek makes two types of reflective assemblies; focused and unfocused.

### A. Focused Reflective Assemblies

The focused version is made from discrete devices with convex lenses. Figure 1 shows three versions of this configuration. (Discrete devices are internal to the housing and are not shown.)

**Figure 1** – Focused Reflective Assemblies

OPB700,701 OPB704 OPB742,745

In this device type, the on-state collector current, $I_{C(ON)}$, peaks when a reflective surface is placed 0.100" to 0.200" (2.5 to 5.0 mm) in front of the assembly.

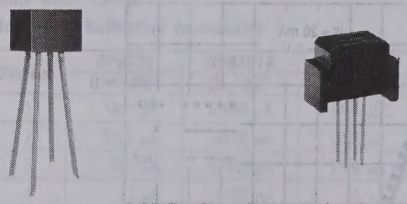
$I_{C(ON)}$ is the collector current created from the reflected infrared radiation emitted from the LED and detected by the sensor from a reflective surface. $I_{C(ON)}$ maximum is 75% of the distance to the intersection of the optical axes of the LED and photosensor. In other words, discretes focused to a reflective surface at a distance from the housing of .200" would have an approximate peak $I_{C(ON)}$ at .150". This is due to the emitted radiation following a diverging pattern rather than a straight line through its center line and the sensor viewing a converging pattern rather than a straight line through its center line. The angular mountings of the discretes are ideal for detecting the presence of a polished or specular surface.

[1] The ratio between the minimum and the maximum amount of reflected infrared radiation seen by the sensor.

### B. Unfocused Reflective Assemblies

The unfocused version is made from discrete devices with plano or non-magnifying lenses. Figure 2 shows two versions of this configuration.

**Figure 2**

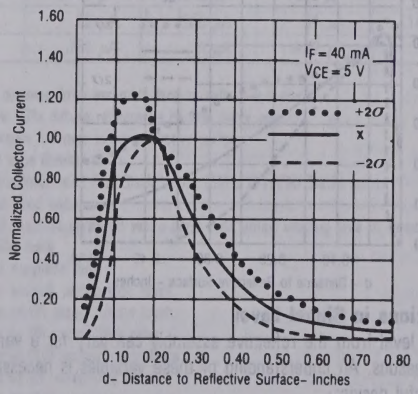


OPB706, 707 OPB711, 712

In this type of device the $I_{C(ON)}$ peaks when a reflective surface is placed 0.050" to 0.080" (1.25 to 2.0 mm) in front of the assembly. The units are designed for mounting in sockets or printed circuit boards. Plano lenses make unfocused assemblies ideal for detecting the presence of diffuse surfaces.

Figure 3 shows variation in output versus distance from a given reflective surface for both focused and unfocused devices.

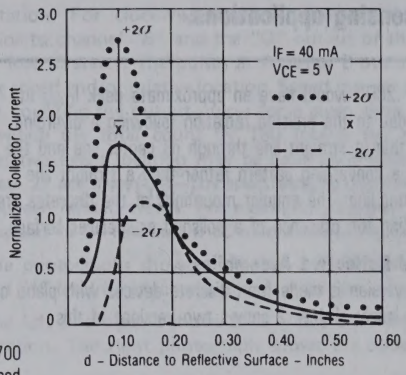
**Figure 3** – Normalized Collector Current vs. Distance to Reflective Surface



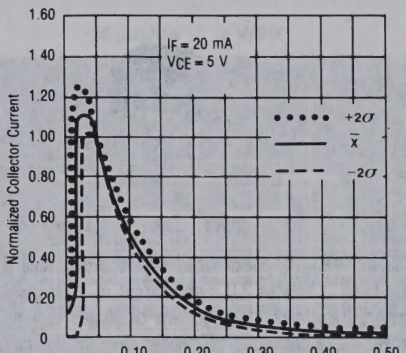

OPB704
Focused



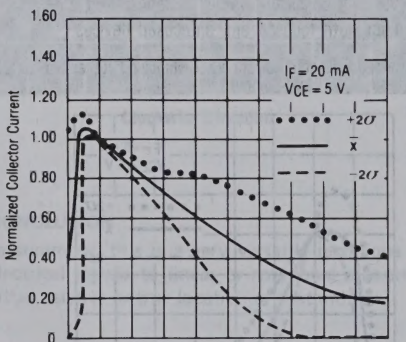
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.




OPB700
Focused




OPB706
Unfocused




OPB707
Unfocused

### C. Variations in Signal Level

The signal level from the reflective assembly can vary for a variety of other reasons. An understanding of these variables is necessary for successful design:

1. Variations in Distance (or inconsistency in placement of reflective surfaces). Since the output from the sensor will decrease (see Figure 3) as the distance between the reflective surface and the assembly increases, the designer must either minimize the physical variation or compensate for it in the electrical design. Table 1 shows the magnitude of signal changes at various distances.

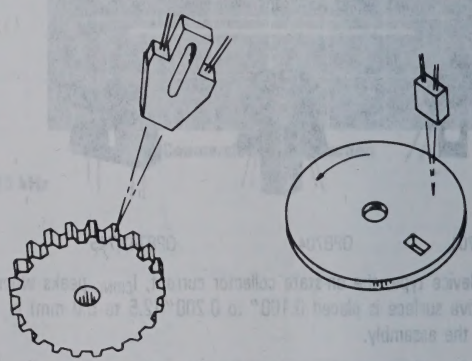
**Table I** – Typical Variation in Signal Level with Distance Changes (Data Sheet Conditions for $I_{C(ON)}$)

| D (a) (b) | OPB700 | OPB704 | OPB706 | OPB742 | OPB711 |
|---|---|---|---|---|---|
| .025 | 12 μA | 35 μA | 1270 μA | 34 μA | 855 μA |
| .050 | 89 μA | 89 μA | 1111 μA | 175 μA | 726 μA |
| .100 | 345 μA | 233 μA | 552 μA | 537 μA | 523 μA |
| .200 | 254 μA | 277 μA | 202 μA | 359 μA | 185 μA |
| .300 | 135 μA | 159 μA | 81 μA | 100 μA | 83 μA |
| .450 | 63 μA | 59 μA | 34 μA | 23 μA | 34 μA |
| .500 | 54 μA | 44 μA | 26 μA | 17 μA | 26 μA |

**Notes:**
(a) D is distance from assembly face to reflective surface.
(b) Reflective surface is 90% diffuse reflectance Kodak neutral white test card.

This phenomenon can be used to an advantage in certain reflective applications. Figure 4 shows an OPB704 sensing gear teeth. Good contrast ratios are obtained since the distance to the reflective surface significantly varies. Figure 4 also shows an OPB706 used as a tachometer. The cutout in the encoder wheel allows one pulse per revolution. The OPB704 uses sensitivity vs. distance while the OPB706 uses sensitivity vs. reflective surface at a given distance.

**Figure 4** – Applications vs. Contrast Ratios



OPB700 OPB706

2. Variation in Reflectivity of Surfaces–Many designers make the initial mistake of assuming that a photosensor will see infrared radiation the same way the human eye sees visible light. This frequently is not the case. In fact, a black surface and a white surface can have similar reflective properties when illuminated with infrared radiation. Tables 2 and 3 show the variation in signal level with different reflective surfaces.

**Table 2** – Focused Reflective Assemblies
Typical $I_{C(ON)}$ (Signal) vs. Reflective Surfaces
(Standard Data Sheet Conditions used for distance, LED forward current and sensor supply voltage)

**Focused Reflective Assemblies**

| Surface | OPB700 | OPB701 | OPB742 | OPB704 | OPB745 |
|---|---|---|---|---|---|
| | D[a]=.20" | D=.20" | D=.150" | D=.20" | D=.150" |
| 1 | 689 µA | 33390 µA | 6160 µA | 6260 µA | 41180 µA |
| 2 | 680 µA | 33850 µA | 5890 µA | 6340 µA | 39120 µA |
| 3 | 1.59 µA | 34.55 µA | 6.39 µA | 13.23 µA | 22940 µA |
| 4 | 115 µA | 5420 µA | 420 µA | 750 µA | 3720 µA |
| 5 | 85 µA | 4330 µA | 320 µA | 580 µA | 2920 µA |
| 6 | 51 µA | 2250 µA | 230 µA | 400 µA | 1810 µA |
| 7 | 42 µA | 1660 µA | 410 µA | 460 µA | 3010 µA |
| 8 | 123 µA | 7920 µA | 728 µA | 1090 µA | 5040 µA |
| 9 | 90 µA | 4850 µA | 351 µA | 688 µA | 2750 µA |
| 10 | 118 µA | 7330 µA | 648 µA | 1020 µA | 4850 µA |
| 11 | 100 µA | 5760 µA | 439 µA | 799 µA | 3290 µA |
| 12 | 116 µA | 7010 µA | 614 µA | 984 µA | 4620 µA |
| 13 | 106 µA | 6080 µA | 471 µA | 845 µA | 3600 µA |
| 14 | 67 µA | 3490 µA | 430 µA | 605 µA | 2690 µA |
| 15 | 1.39 µA | 36.07 µA | 6.76 µA | 13.50 µA | 24.76 µA |
| 16 | 0.24 µA | 9.17 µA | 1.55 µA | 3.87 µA | 1.08 µA |

**Notes:**
(a) D is distance from assembly face to reflective surface.
1. Aluminum foil tape (shiny, efficient reflective surface).
2. Alzak (similar to 1).
3. Alzak painted with Flat Black Velvet (3M #101-C10 Black). Painted surface destroys shiny reflective surface and gives velvety matte finish.
4. Kodak 90% diffuse reflectance neutral white paper.
5. White bond paper.
6. No. 3 graphite pencil on white bond with entire viewing of sensor shaded by graphite mark.
7. Mylar magnetic tape.
8. Clear, smooth plastic tape finish.
9. Same as (8) except matte finish.
10. Same as (8) except blue color.
11. Same as (10) except matte finish.
12. Same as (8) except red color.
13. Same as (12) except matte finish.
14. Same as (8) except gray color.
15. 3M Tape No. 476 (a dull black surface).
16. No reflective surface.

Several interesting observations can be made.

I. The shiny metallic surfaces of (1) and (2) give the best reflectance.

II. The black velvet paint gives excellent contrast between (2) and (3).

III. The signal level drops when using diffuse reflectance, (4) neutral white paper, bond paper (5), or mylar magnetic tape (7).

IV. The graphite pencil mark gives relatively small change since it both improves the reflectivity (smeared shiny graphite) and disrupts the pore fibers of the paper.

V. Plastic surfaces do not reflect as well as polished surfaces. Examples: (8), (10), (12), (13)

VI. Plastic matte reflects almost as well as plastic smooth surfaces. Examples: (8) versus (9); (10) versus (11); (12) versus (13).

VII. Color makes very little difference. Examples: (8), (10), (12), and (14), or (9), (11), and (13).

VIII. The 3M tape #476 is an excellent non-reflecting surface (15).

IX. The best non-reflecting surface is no surface (16).

**Table 3** – Unfocused Reflective Assemblies
Typical $I_{C(ON)}$ (Signal) vs. Reflective Surfaces
(Standard data sheet conditions used for distance, LED forward current and sensor supply voltage)

**Unfocused Reflective Assemblies**

| Surface | OPB706 | OPB707A | OPB711 | OPB712 |
|---|---|---|---|---|
| | D[a]=.05" | D=.05" | D=.08" | D=.08" |
| 1 | 1950 µA | 53990 µA | 1430 µA | 31630 µA |
| 2 | 1000 µA | 54250 µA | 1220 µA | 29930 µA |
| 3 | 960 µA | 52350 µA | 1220 µA | 29160 µA |
| 4 | 21 µA | 3400 µA | 31 µA | 1160 µA |
| 5 | 860 µA | 52330 µA | 1050 µA | 28700 µA |
| 6 | 390 µA | 41920 µA | 520 µA | 21900 µA |
| 7 | 95 µA | 17260 µA | 130 µA | 5670 µA |
| 8 | 964 µA | 52990 µA | 1360 µA | 31330 µA |
| 9 | 913 µA | 47570 µA | 1230 µA | 31400 µA |
| 10 | 985 µA | 52260 µA | 1300 µA | 31100 µA |
| 11 | 961 µA | 52270 µA | 1280 µA | 30800 µA |
| 12 | 996 µA | 52810 µA | 1310 µA | 31500 µA |
| 13 | 972 µA | 52520 µA | 1380 µA | 31200 µA |
| 14 | 4740 µA | 39340 µA | 650 µA | 24260 µA |
| 15 | .02 µA | 4250 µA | 34 µA | 1400 µA |
| 16 | .751 µA | .51 µA | 4.32 µA | .2 µA |

**Notes:**
(a) D is distance from assembly face to reflective surface.
1. Kodak 90% diffuse reflectance neutral white paper.
2. Aluminum foil tape (shiny reflective surface).
3. Alzak tape (similar to 2).
4. Alzak painted with Flat Black Velvet (3M #101-C10 Black) paint.
5. White bond paper.
6. No. 3 graphite pencil on white bond with entire viewing area of sensor shaded by graphite mark.
7. Mylar magnetic tape.
8. Clear, smooth plastic tape finish.
9. Same as (8) except matte finish.
10. Same as (8) except blue color.
11. Same as (10) except matte finish.
12. Same as (8) except red color.
13. Same as (12) except matte finish.
14. Same as (8) except gray color.
15. 3M Tape #476 (a dull black surface).
16. No reflective surface.



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

The same type of observation can be made about unfocused assemblies as were made on focused assemblies with one exception:

The Kodak 90% diffused reflectance neutral white paper offers the best reflective surface.

The information in Table 2 and Table 3 can be used to design the surface in your system.

3. Variations in Reflective Surface Size–Another problem may arise as a result of the size of the reflective area. An optimum sized reflective surface would be one which will yield no increase in $I_{C(ON)}$ when its size is increased. Then as the size of the reflective surface shrinks from the optimum size the signal level will decrease. As a result, these units are better used as surface detectors than as mark or line detectors.

4. Variations in $I_{C(ON)}$ from Assembly to Assembly–There is a wide $I_{C(ON)}$ variation from assembly to assembly. Table 4 shows this variation.

**Table 4** – Minimum, Typical, and Maximum $I_{C(ON)}$(1)
(Data Sheet Conditions for $I_{C(ON)}$)

| Sensor | $I_{C(ON)}$ Min. | $I_{C(ON)}$ Typ. | $I_{C(ON)}$ Max. (2) |
|---|---|---|---|
| OPB701 | 2000 μA | 8400 μA | 14500 μA |
| OPB700 | 25 μA | 125 μA | 168 μA |
| OPB704 | 200 μA | 500 μA | 1100 μA |
| OPB742 | 10 μA | 25 μA | 1100 μA |
| OPB745 | 1000 μA | 8000 μA | 12000 μA |
| OPB706A | 500 μA | 1000 μA | 2500 μA |
| OPB706B | 350 μA | 700 μA | 1920 μA |
| OPB706C | 200 μA | 400 μA | 1820 μA |
| OPB707A | 25000 μA | 50000 μA | 59400 μA |
| OPB707B | 17000 μA | 34000 μA | 43500 μA |
| OPB707C | 10000 μA | 20000 μA | 39300 μA |
| OPB711 | 350 μA | 700 μA | 1950 μA |
| OPB712 | 20000 μA | 40000 μA | 60000 μA |

**Notes:** (1) Measurements taken using an Eastman Kodak neutral white test card having 90% diffuse reflectance as a reflective surface placed at the optimum distance from the assembly head.

(2) The maximums are not a guaranteed specification as they are calculated from the two sigma points based on the distribution.

5. Variations in Signal Levels Due to Sporadic Problems–Spurious reflections due to illumination from outside sources may cause false triggering. Also foreign material can decrease the desired "on" signal, depending on what it is and where it is located. Consideration must be given to these sources.

## D. Applications

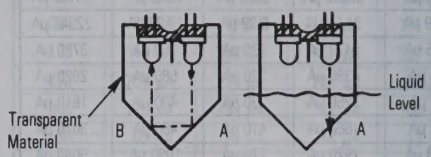
A variety of applications are well suited to reflective assemblies.

a) The variability in output versus distance can be used to detect variations in surface location.

b) The variability in reflectivity can be used to measure surface roughness.

c) Liquid level sensors are easily fabricated as shown by the illustration in Figure 5. The radiation normally would be reflected from surface "A" to surface "B". When liquid covers surfaces A and B, the change in the index of refraction causes the radiation to continue through surface "A", and not to be reflected back to the receiving sensor.

**Figure 5** – Liquid Level Sensor

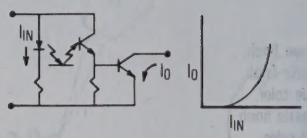



d) Reflective assemblies have wide applications in industrial controls and surveillance applications where a retro-reflective surface sends the light back to the sensor. This normally requires a custom assembly as the distances covered may span up to 50 feet.

e) Reflective assemblies have wide applications in office machines for detecting the presence or absence of paper as it moves through the machine. A variety of special techniques are used to improve the contrast ratio. Many of these designs use custom packages. Figure 6 shows some of these special techniques.

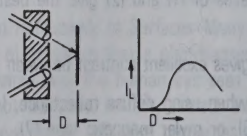
**Figure 6** – Special Techniques for Improving Contrast Ratios

**Non-Linear Transfer Function Improves Contrast Ratio**



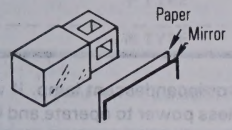

- Customer requirements for electrical performance and mechanical configuration are met exactly.

**Optical Techniques Used to Reject Reflections from Close Objects**

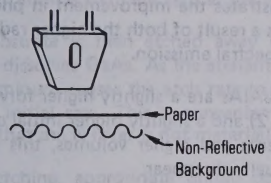



- Development costs vary depending on complexity.

**Figure 6** – Special Techniques for Improving Contrast Ratios (continued)



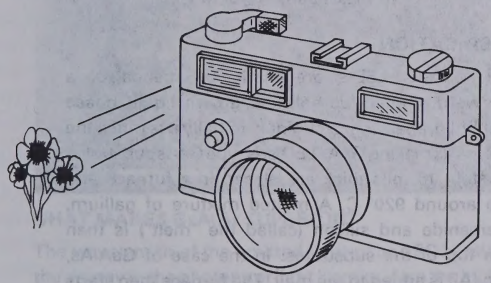

- Paper interruptive is less reflective than the mirror background




- Paper interruptive is more reflective than non-reflective background.

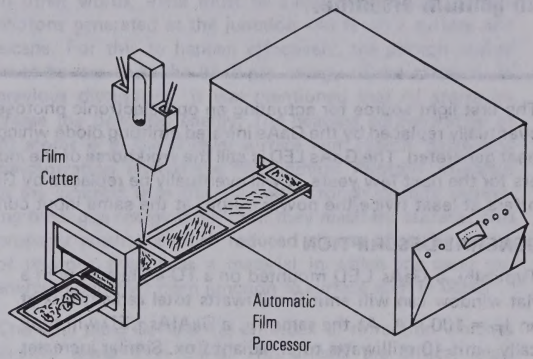
f) A sophisticated camera application is shown in Figure 7. The system can work as either a flash control or a shutter control. When used as a shutter control the photosensor receives outside light when the shutter is open. When the amount of outside light reaches a predetermined level (adequate for film exposure), the shutter is closed. The flash control is similar except the photosensor shuts off the flash when a predetermined amount of light is reflected from the subject to the sensor.

**Figure 7** – Automatic Shutter or Flash Control



g) Reflective sensors can also be used in high speed print cutting. Figure 8 shows this application. The machine processor prints a thin black line on the white border between each print. The black line causes a small decrease in the amount of light reflected back into the photosensor which causes the print cutter mechanism to trigger.

**Figure 8** – OPB701 – High Speed Print Cutting




## Conclusion

The information presented should allow the designer to understand the basic variables that exist in reflective assemblies. An understanding of these variables will allow the designer to decide on the best reflective assembly for his application and how to choose other system piece parts for a successful design and implementation.

**Tom Sward**

APPLICATION BULLETINS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Gallium aluminum arsenide – a new generation of infrared LEDs superior to gallium arsenide.

The first light source for actuating an optoelectronic photosensor was the tungsten filament or incandescent lamp. It was eventually replaced by the GaAs infrared emitting diode which offered longer life, smaller size, less power to operate and less heat generated. The GaAs LED is still the workhorse of the industry and will continue to be used in steadily decreasing numbers for the next few years. It will eventually be replaced by GaAlAs as the industry standard for two major reasons: GaAlAs offers at least twice the power output at the same input current ($I_F$) level and significantly improved coupling efficiency.

## GENERAL DESCRIPTION

Typically, a GaAs LED mounted on a TO-46 header with a flat window can will emit 5 milliwatts total radiant flux at an $I_F$ = 100 mA. At the same $I_F$, a GaAlAs LED will typically emit 10 milliwatts total radiant flux. Similar increases are possible in other packages. This allows the designer some options which have not been available before.

In addition, silicon doped GaAs has a spectral emission centered at approximately 935 nanometers. GaAlAs has a spectral emission at approximately 890 nanometers which is very close to the peak response of silicon phototransistors. This improves coupling efficiency by approximately 30%.

**FIGURE 1**

Photodiode Collector Current Versus LED Forward Current With Both GaAlAs and GaAs

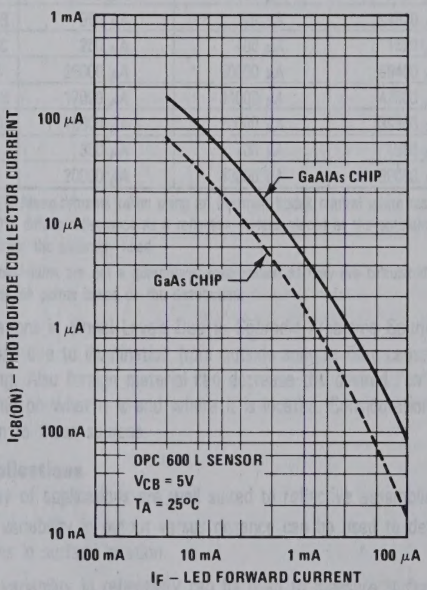
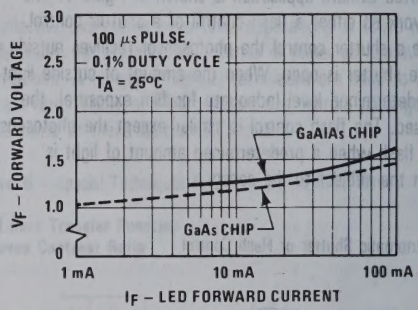



Figure 1 graphically illustrates the improvement in photodiode collector current as a result of both the higher radiant flux and the optimized spectral emission.

The only negatives to GaAlAs are a slightly higher forward voltage ($V_F$) (see Figure 2) and a slightly higher initial cost. With process improvements and higher volumes, this cost difference whould eventually disappear.

**FIGURE 2**

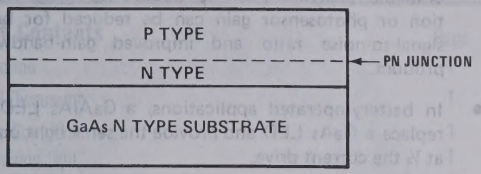
Forward Voltage Versus LED Forward Current




## CHIP FABRICATION

All Optek GaAlAs LED's are made by means of a straightforward single step solution grown liquid phase epitaxial (LPE) preparation technique. Initially it is much the same process as making GaAs LED's. N type GaAs substrates approximately 16 mils thick are placed in a furnace and heated to around 920° C. A melted mixture of gallium, gallium arsenide and silicon (called the "melt") is then placed on top of the substrates. In the case of GaAlAs, aluminum (Al) is added to the melt. The furnace then starts cooling, and an epitaxial N type layer begins to grow on top of the substrates. As the cooling continues, the silicon in the melt which is amphoteric changes polarity or "flips" to P type material at approximately 900° C, forming the PN junction. The growth process continues until the epi layer reaches a thickness of 7-8 mils. (See Figure 3.)

**FIGURE 3**
Typical Epitaxial Layer Growth

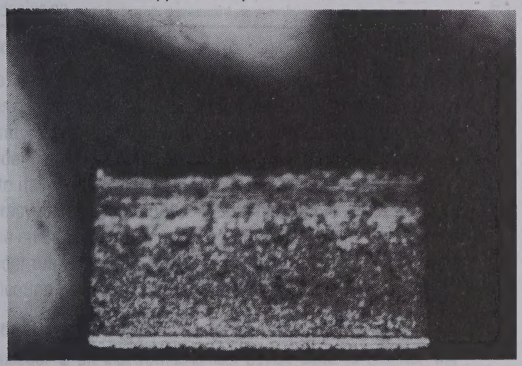



The nature of the Al in the melt is such that it is depleted or used up rapidly in the early stages of the epi growth. Concentration is virtually zero at the top of the P layer.

The substrate is then etched away with an etchant that readily dissolves GaAs. As the etchant contacts the N layer, the aluminum causes the etch rate to be slowed to 1/100th of the initial rate. This is convenient because it helps to ensure that the N layer is not materially etched.

After etching, appropriate ohmic contacts are added by evaporation techniques. A gold contact completely covers the P layer or backside, and a dot matrix contact is put on the N layer or topside. The chips are then sawed into their final size. A final etching is done to remove saw damage and to roughen the surface of the N layer which enhances light output. (See Figure 4.)

**FIGURE 4**
Typical Chip Cross Section



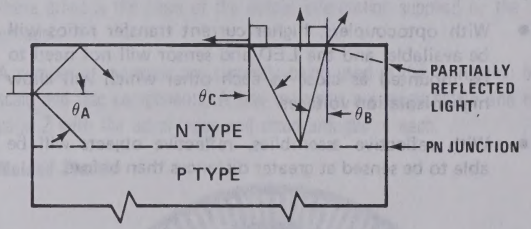
**WHAT MAKES GaAlAs SUPERIOR?**

The wavelength of the emitted light of an LED is related to the energy in the photons of light it emits. Also the higher the band gap energy of the semiconductor material, the higher the photon energy. Al atoms increase the band gap energy in proportion to the concentration which allows adjustment of the photon wavelength. By controlling this concentration, the wavelength can be varied to approximate the peak spectral response of a silicon phototransistor or 890 nanometers.

GaAlAs also has an improved radiation window. In order for an LED to emit more light, absorption of photons traveling through the material must be as low as possible. In other words, there must be a high probability that the photons generated at the junction will reach a surface and escape. For this to happen effectively, the photon energy must be less than the band gap energy of the material. In previous discussions, it was mentioned that Al atoms increase the band gap energy. The heaviest concentration of Al atoms is at the N layer surface with rapidly decreasing concentration toward the PN junction. Photons generated at the junction then travel a path through steadily increasing band gap energy levels until they reach the surface. This property ensures a much reduced chance of re-absorption of photons than does a material in which the band gap energy is constant from junction to surface such as GaAs.

One final plus, GaAlAs has an index of refraction which is slightly lower than GaAs. This affects the critical angle which defines the angle at which there is total internal reflection. (See Figure 5.)

**FIGURE 5**
Definition of Critical Angle




The critical angle is determined by the formula:

$$\text{SIN } \theta_C = \frac{n_1}{n_2}$$

Where $n_1$ is the index of refraction of air, or 1, and $n_2$ is the index of refraction of the chip material.

With GaAs, $n_2 = 3.6$

$$\text{SIN } \theta_C = \frac{1}{3.6}$$

$$\theta_C = 16^\circ$$

With GaAlAs, $n_2 = 3.4$

$$\text{SIN } \theta_C = \frac{1}{3.4}$$

$$\theta_C = 17^\circ$$

At angles less than the critical angle, there is partial reflection. (See angle $\theta_B$ in Figure 5.) At angles greater than the critical angle, there is total internal reflection. (See angle $\theta_A$ in Figure 5.)

There are ways of improving surface emission. One, mentioned earlier, is the post-dicing etch cleanup which roughens the chip surface. This increases the likelihood of photons striking the surface at less than the critical angle. Another improvement is the addition of a clear epoxy, anti-reflective, domed lens placed over the chip which actually enlarges the critical angle to approximately 24°.



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

## RELIABILITY

Since GaAlAs and GaAs junctions are formed in the same manner, the chips should have the same reliability. Life tests to date indicate that this is true. Data shows that both GaAlAs and GaAs have from 5 to 8% degradation after 1,000 hours of maximum rated operation.

## DRAWBACKS

GaAlAs has inherently high $V_F$. The higher the band gap energy, the higher the $V_F$ must be to impart adequate energy to the electrons. Typical $V_F$ for Optek's GaAs LED's at 100 mA is 1.5V vs. 1.75V for GaAlAs. This difference increases slightly at higher current levels.

## CONCLUSION

Many power-starved optical assembly packages will be helped immediately by using GaAlAs. Special optosensor assemblies such as card readers, paper tape readers, paper sensors and precision shaft encoders will become easier to design.

Electronic assemblies which operated with an LED/sensor pair will benefit immediately.

- With optocouplers, higher current transfer ratios will be available, and the LED and sensor will not need to be mounted as close to each other which will allow higher isolation voltages.
- With reflective assemblies, reflective objects will be able to be sensed at greater distances than before.
- With interrupter assemblies, precise alignment and gap width will not be as critical. Since there is more light available, aperturing can be reduced for higher resolution or photosensor gain can be reduced for better signal-to-noise ratio and improved gain-bandwidth product.
- In battery-operated applications, a GaAlAs LED can replace a GaAs LED and provide the same light output at ½ the current drive.
- Since the same light output can be produced at ½ the current drive, GaAlAs LED's will have much longer operating life.

GaAlAs, with its superior performance, will give the designer more options and design flexibilities than were previously available.

DEAN WOLFE

Application Bulletin 206
July 1989

# Linear and rotary encoders are evolving to meet the demands of new system requirements, higher performance requirements, harsh environmental conditions and lower cost.

## Table of Contents


| | Page |
|---|---|
| 1. Introduction | 1 |
| 2. General Discussion | 1 |
| 3. Encoder Components | 1 |
| a. The "Moving Unit" | 1 |
| b. The "Stationary Unit" | 2 |
| 4. Operating Principles | 3 |
| a. Modulating the Light Source | 3 |
| b. The Light Shutter | 3 |
| c. Quadrature | 4 |
| 5. Sensing Circuit Techniques | 4 |
| a. Single-Ended Encoders | 4 |
| b. Convoluted Duty Cycle Encoders | 4 |
| c. Automatic Gain Control | 4 |
| d. Differential Circuitry | 4 |
| e. Zero Referencing | 5 |
| 6. Mechanical Interfacing | 5 |
| a. Mounting the Moving Unit | 5 |
| b. Mounting the Stationary Unit | 5 |
| c. Maintaining the Gap | 5 |
| d. Error Related to the Gap | 6 |
| e. Performance Limits | 6 |
| 7. Conclusion | 6 |


## Introduction

Linear and rotary encoders have come in a wide variety of design styles over the years, the most common being rotary switches, potentiometers, capacitive, magnetic, and optical types. The optical encoder has become the most popular of these encoding methods due to its long life, simplicity of construction, versatility, high accuracy and high resolution. This application bulletin will briefly define an optical encoder, and bring the designer up to date on encoder terminology, design techniques and limitations. Refer to Application Bulletins 201 and 203 for additional information.

## General Discussion

An encoder is an electromechanical device used to monitor the motion or position of an operating mechanism, and to translate that information into a useful output. We define an optical encoder as an optoelectronic device which translates rotational or linear movement into some usable electronic waveform. Encoders generally consist of two parts; a "moving unit" which is attached to and moves with the device being monitored. The moving unit contains information to be sensed by the "stationary unit." The stationary unit consists of an LED and a photosensor (or a combination of LEDs and photosensors) mounted on opposite sides of a slot through which the moving unit passes, thereby modulating the light path(s).

The types of output information available are speed, velocity (speed with direction) and relative or absolute positioning. The output can be either analog or digital depending on the type of photosensor used. For a more thorough description of encoding techniques, refer to Optek Bulletin 201.

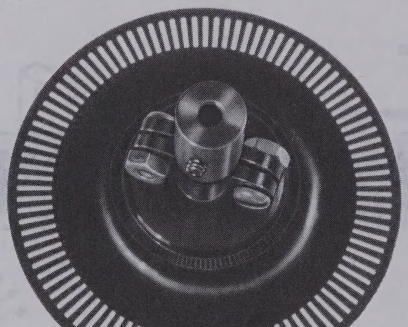
## Encoder Components

### a. The Moving Unit

The modulation of the light path(s) in the optical encoder is accomplished by the moving unit which is a "scale" (linear encoder) or a "disc" (rotational encoder). The scale or disc is attached to the operating mechanism and contains alternating areas of transparency and opacity to the light path. The size, shape, and frequency of these areas is the basis of the output information supplied by the encoder.

A number of materials are currently being used in the fabrication of scale and disc components. A few examples are given below and on page 2 with the advantages and disadvantages of each.

**Molded Plastic**



| Advantages | Disadvantages |
|---|---|
| Low cost | Resolution of < 50 lines per inch |
| Durable | Relative mechanical and thermal instability |

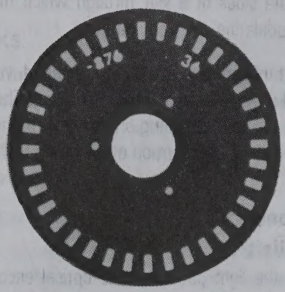
APPLICATION BULLETINS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

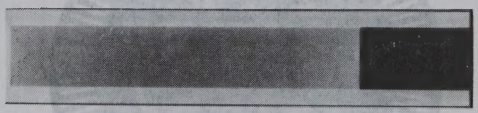
OPTEK

**Etched Metal**



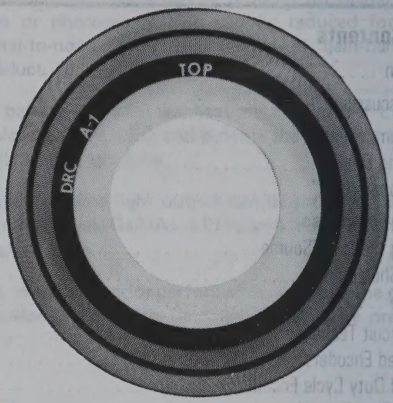

| Advantages | Disadvantages |
|---|---|
| Reasonable cost | Resolution of < 150 lines per inch |
| Resistant to shock and vibration | |
| Good thermal stability | |

**Mylar Film**



| Advantages | Disadvantages |
|---|---|
| Reasonable cost | Mechanical, thermal, and humidity instability |
| Resolution of < 1000 lines per inch | Can be damaged in handling |

**Chrome on Glass**




| Advantages | Disadvantages |
|---|---|
| Resolution of > 2500 lines per inch | High cost |
| Excellent optical quality | Can be damaged in handling |
| Excellent mechanical, thermal and humidity stability | |

**b. The Stationary Unit**

The stationary unit contains all the components necessary to generate the light source and sense its intensity as it is being modulated by the scale or disc. It sometimes contains the signal conditioning electronics required to amplify and/or digitize the output of the encoder. The light source consists of one or more incandescent lamps or light emitting diodes and may include lensing to improve the collimation of the light source. Most recent optical encoders use LEDs because of their lower cost, longer life, better shock resistance, and lower power consumption.

(1) Sensing Elements

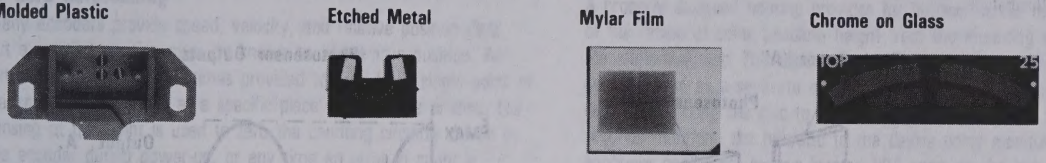
Solar cells, photodiodes, phototransistors, and photosensitive integrated circuits are all used in optical encoders. The Optek Photologic™ series of photosensors was developed to enable the stationary unit to provide a digital output which can be directly interfaced with TTL, LSTTL, CMOS, and other standard logic families.

(2) Apertures and Reticles

One method of improving encoder resolution is the "sizing down" of the photosensitive area. This is done by placing a reticle with

a certain aperture size in front of the photosensor. The reticle contains a pattern of transparent and opaque areas which are optically mated to the scale or disc being "read." The transparent areas are referred to as apertures, and one or more apertures may be placed in the reticle over the photosensor in high resolution designs. Some examples of reticles made of the same materials, and intended to be used with the scale and disc samples discussed earlier, are shown in figure 1. The same advantages and disadvantages apply. In the case of molded plastic, apertures are molded right into the housing.

**Figure 1** – Examples of Reticles




(3) Signal Conditioning Electronics

Resistors, capacitors, integrated circuits, input/output connectors, and additional components are often contained on a printed circuit board in the stationary unit. These components are used to amplify the photosensor output and interface the encoder to the system in which it is used.

(4) Housing

The components used in the construction of the stationary unit are usually held in position by mounting them into a metal or plastic housing. The housing is then mounted to the operating mechanism (motor, etc.) to optimize the interface between the moving and stationary units. In some cases, the moving and stationary units are packaged together and external linkages are provided for coupling the packaged encoder to the operating mechanism.

## Operating Principles

### a. Modulating the Light Source

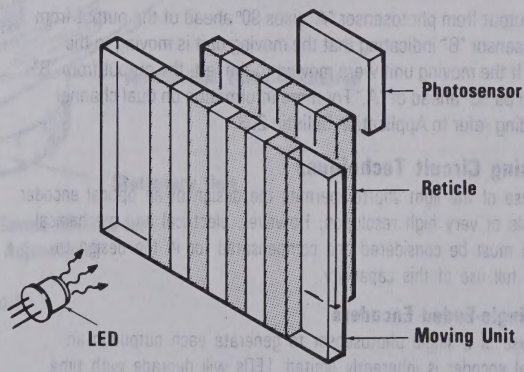
The movement of the scale or disc in the light path is the source of modulation of the light in an optical encoder. A simple example of modulation would be the interruption of the light beam in a burglar alarm. The momentary interruption or reduction of light is easily detected. As resolution requirements increase, apertures become smaller and detection becomes more difficult. An improvement over standard aperturing is the light shutter.

### b. The Light Shutter

The reticles used in optical encoders may contain 20 or more alternating transparent/opaque areas in front of each sensor. If the moving unit and the reticle have identically matched patterns of 50% duty cycle (transparent and opaque areas are the same width) then the emitted light received by the sensor will be at a maximum when all the transparent areas of the reticle are exactly superimposed with those of the moving unit, as illustrated in figure 2.

When the moving unit moves one area width, the emitted light received by the sensor will be at a minimum, but not zero since in this type of light modulation there is some slight light leakage around the opaque areas in the moving unit. This sequence repeats for each cycle of movement, and is referred to as the "light-shutter" because of the similarity of operation to a camera shutter.

**Figure 2** – Light Shutter




APPLICATION BULLETINS

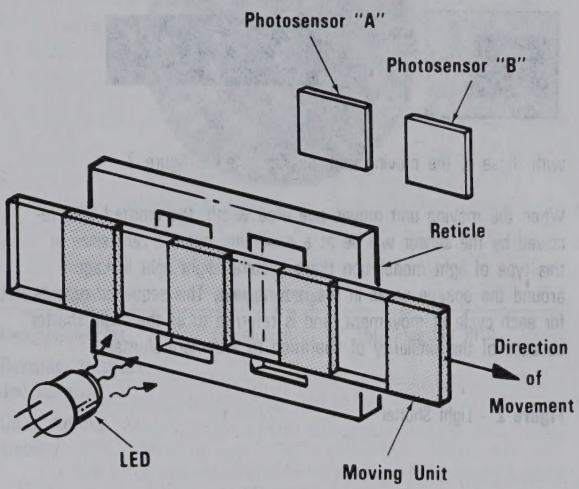
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

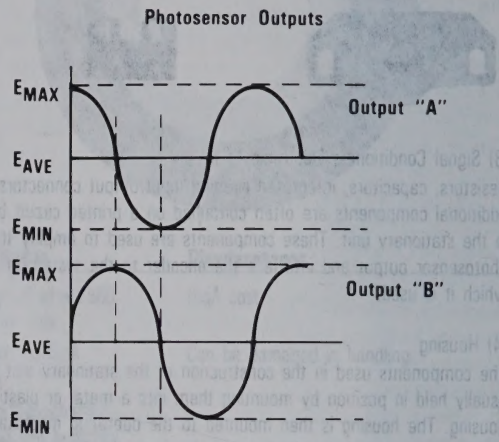
OPTEK

### c. Quadrature

Determination of direction of movement of the moving unit is also possible by locating two photosensors in the encoder and mechanically shifting the aperture pattern in the reticle over one photosensor, ¼ cycle from the aperture pattern in the reticle over the other photosensor as shown below. This causes a "phase shift" in the output of one photosensor relative to the other and indicates direction of motion. This phase relationship is called "Quadrature," and is illustrated in figure 3.

**Figure 3** – Quadrature




The output from photosensor "A" rises 90° ahead of the output from photosensor "B" indicating that the moving unit is moving to the right. If the moving unit were moving to the left, the output from "B" would be 90° ahead of "A." For more information on dual channel encoding refer to Application Bulletin 203.

## Sensing Circuit Techniques

The use of the light shutter permits the design of an optical encoder capable of very high resolution. However, electrical and mechanical errors must be considered and compensated for in the design to allow full use of this capability.

### a. Single-Ended Encoders

The use of a single photosensor to generate each output in an optical encoder is inherently limited. LEDs will degrade with time and temperature resulting in changes in the output signal shape and level. However, if performance requirements are not severe, the single ended approach offers the simplest design approach and lowest cost.

### b. Convoluted Duty Cycle Encoders

The use of 50% duty cycle components in a single-ended encoder does not necessarily guarantee the optimum in performance. A reduction in the duty cycle of the reticle (making the opaque area wider than the transparent area) and an increase in LED drive current will improve the output performance of an encoder that is being digitized by a comparator. Operating a phototransistor at very high light conditions will tend to reduce its frequency response. The use of convoluted duty cycle usually requires the use of a photodiode type of photosensor. Opteks Photologic™ series of photosensors are ideally suited for this type of application.

### c. Automatic Gain Control

An unmodulated photosensor channel can be incorporated exclusively to monitor the intensity of the emitted light from the LED. Feedback is then provided to a drive circuit powering the LED. This compensates for degradation from all causes and will enhance the long term performance of the encoder. The trade-off is in increased cost and circuit complexity.

### d. Differential Circuitry

By generating quadrature in "complementary format" (i.e., 0°/180°, 90°/270°), the complementary phases may be differentially amplified or compared to generate the required quadrature output

(generally 0° and 90°). This approach allows noise reduction and drift compensation. An additional advantage is the ability to operate high gain phototransistors in the nonsaturated mode, thereby improving frequency response. The negatives are increased cost and circuit complexity.

### e. Zero Referencing

Many encoders provide speed, velocity, and relative position data, but a starting position must be known to derive true position. An extra photosensor is sometimes provided to look for a single point of transparency or opacity at a specific place on the scale or disc. The sensing of this point is used to zero the counting circuitry driven by the encoder during power-up, or any time an error in count is detected.

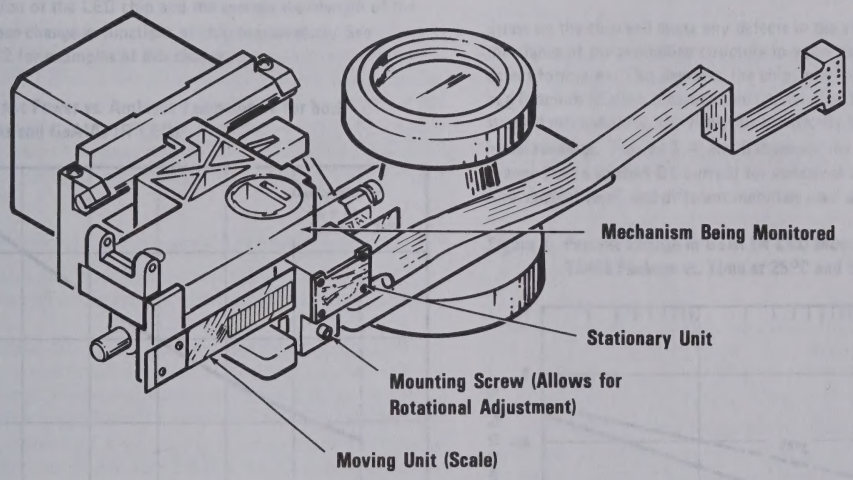
## Mechanical Interfacing

The best possible performance from an optical encoder is dependent on the proper selection of materials, circuit design and the integrity with which the encoder is attached to the operating mechanism. The space between the scale or disc and the reticle must be as narrow as possible and consistently maintained throughout the travel of the moving unit. Variations will result in degraded performance.

### a. Mounting The Moving Unit

A properly designed housing provides for flatness across the surface of the reticle at some absolute height from the mounting surface of the stationary unit. This allows the positioning of the moving unit to be performed as a separate operation. Disc mounting requires two steps: (1) affixing the disc to a hub using adhesive and/or a clamp ring; (2) mounting the hub/disc to the device being monitored using adhesives and/or set screws located 90° apart on the hub. Linear scales are mounted to a bracket on the operating mechanism at one or both ends. The entire scale must travel evenly and precisely through both end extremes. A typical encoder mounting application is illustrated in figure 4.

**Figure 4** – Encoder Mounting




### b. Mounting the Stationary Unit

The stationary unit should be designed to allow rotational or displacement adjustments. These adjustments compensate for mechanical tolerances in fabrication of the stationary and moving units that could prohibit the final fine tuning needed by the light shutter.

### c. Maintaining the Gap

The distance between the scale or disc, and the reticle is referred to as the "gap." In photo-emulsion type light shutter components, the emulsion sides should be facing each other and a minimum space maintained to prevent abrasive damage. If the properties of the



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

operating mechanism and the housing are known (thermal expansion, end play, eccentricity, etc.) the moving unit can be mounted using a spacer. Then the fixed unit is simply inserted, adjusted and locked in place. Another solution is a sliding bearing inserted between the shutter components to prevent wear damage.

### d. Error Related to the Gap

A gap of zero width allows for complete modulation of the emitted light shutter. Any increase in gap width will result in reduced modulation where:

$$\% \text{ Modulation} = \frac{\text{Signal Output (ACVpp)}}{\text{Max. Achievable Undistorted Signal Output}} \times 100$$

The reduced modulation is caused by non-collimated light from the LED (i.e., leakage around the shutter components) and becomes substantial as the gap width approaches the aperture width in size.

Variations in the gap during the travel of the moving unit result in amplitude modulation. These variations affect the interface circuitry driven by the encoder during signal conditioning or digitizing and can cause clipping, positive pulse width modulation or variation in time between output pulses (in a pulse output encoder).

The quadrature relationship between the output channels will vary as the sum of the error on each individual channel.

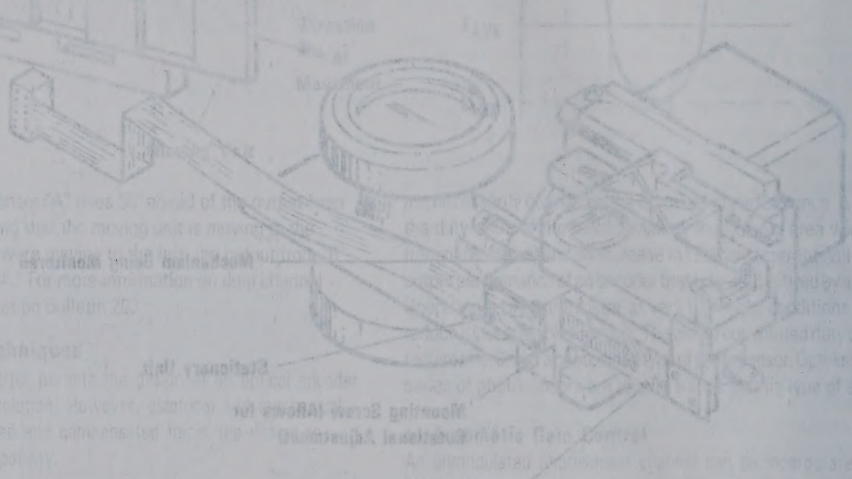
### e. Performance Limits

The optical encoder provides direction information only as long as the quadrature related signals occur in proper sequence. Any phase, duty cycle, or modulation error that interrupts or reverses this sequence defines the ultimate limit of an incremental encoder.

## Conclusion

Optical sensing is currently the most versatile method of motion sensing in rotary and linear applications. LED and photosensitive integrated circuit technology, along with innovative sensing techniques are keeping pace with today's sensing requirements so that the advantages of long life, high resolution, reliable operation in harsh environments, and low cost are available in almost any motion sensing application.

**J. W. Davidson, III**
**Lowell Johnson**



# Understanding infrared diode power ratings.

## Introduction

Infrared emitting diode power measurement is dependent upon a number of variables which must be precisely defined in order for design engineers to utilize data sheet information. Manufacturers differ not only in the techniques used in measuring power, but also in their interpretations of the definitions of the parameters which are measured. This application bulletin is intended to clarify this misunderstanding, especially for GaAs and GaAlAs solution grown epitaxial devices.

## General Discussion

Power is measured in units of energy per unit of time, and the conventional MKS unit is the Watt. Some factors which must be controlled to make accurate power measurements are discussed below.

The energy an LED emits is in the form of photons, and a photon's energy is inversely proportional to its wavelength. To measure the power emitted, the technique must take into account both the rate of photon emission and the average wavelength of the photons. Both the rate emission of the LED chip and the average wavelength of the emitted photons change as functions of chip temperature. See Figures 1 and 2 for examples of this change.

**Figure 1. Output Power vs. Ambient Temperature for both GaAs and GaAlAs IR LEDs**

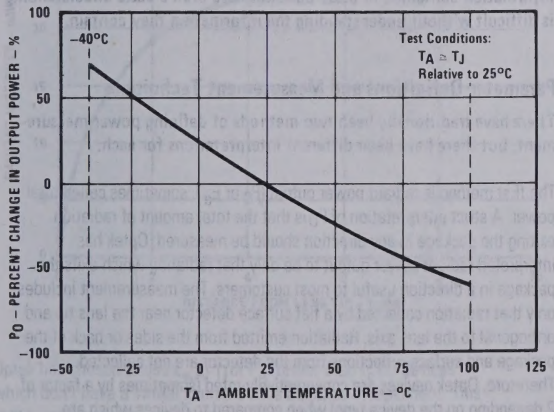
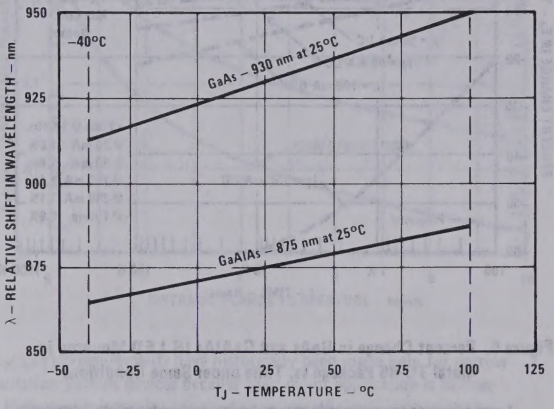
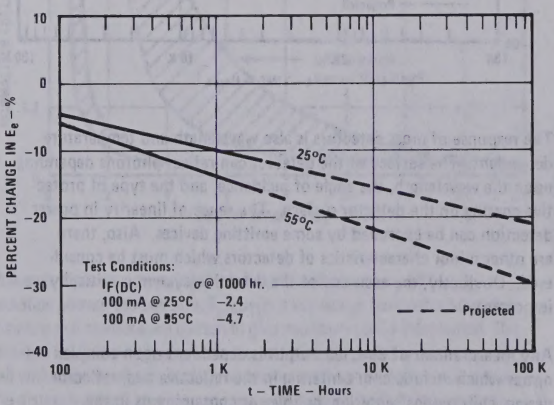



**Figure 2. Peak Wavelength vs. Ambient Temperature for both GaAs and GaAlAs IR LEDs**




Stress on the chip will cause any defects in the chip to expand along the planes of the crystalline structure in a process called dark line defect formation. This degrades the chip, and power output decreases as a function of time. Measurements made after the chip has been stressed mechanically, thermally, or electrically will be lower than initial readings. Figures 3, 4, and 5 illustrate the magnitude of this change due to applied DC current for variations of ambient temperature, current level, and different materials used as emitters.

**Figure 3. Percent Change in GaAs IR LED Mounted in Metal TO-46 Package vs. Time at 25°C and 55°C**






Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

**Figure 4. Percent Change in GaAlAs IR LED Mounted in Plastic TO-46 Package vs. Time at Various Current Levels**

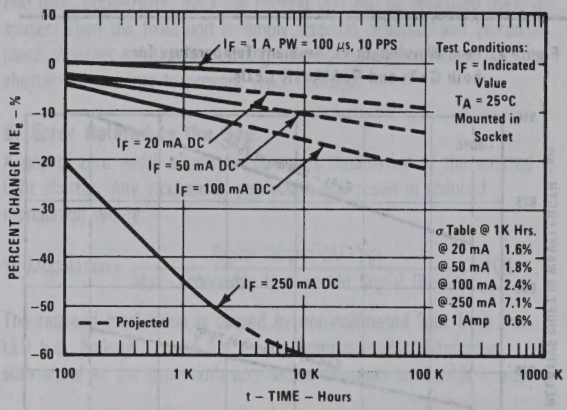
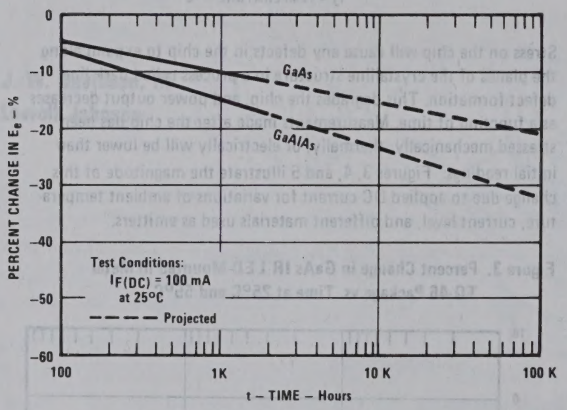

$I_F$ = 1 A, PW = 100 μs, 10 PPS
Test Conditions:
$I_F$ = Indicated Value
$T_A$ = 25°C
Mounted in Socket
$I_F$ = 20 mA DC
$I_F$ = 50 mA DC
$I_F$ = 100 mA DC
$I_F$ = 250 mA DC
σ Table @ 1K Hrs.
@ 20 mA 1.6%
@ 50 mA 1.8%
@ 100 mA 2.4%
@ 250 mA 7.1%
@ 1 Amp 0.6%
Projected
PERCENT CHANGE IN $E_e$ – %
t – TIME – Hours

**Figure 5. Percent Change in GaAs and GaAlAs IR LED Mounted in Metal TO-46 Package vs. Time under Same Conditions**

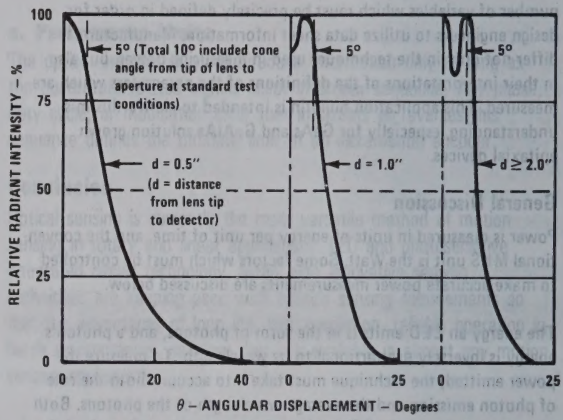



The response of most detectors is also wavelength and temperature dependent. The surface of the detector can reflect photons depending upon the wavelength, the angle of incidence, and the type of protective coating on the detector surface. The range of linearity in power detection can be exceeded by some emitting devices. Also, there are other minor characteristics of detectors which must be considered. Obviously, the accuracy of the detection system is critically important.

Any measurement of directed output is dependent upon complex optics which include chip centering in the reflective cup, reflector design, chip to lens centering, bubbles or contaminants in the packaging, and the fact that approximately half of the emitted photons exit the chip from the side walls rather than the top surface.

Many devices have radiation patterns which change as the distance from the device to the detector is varied, so this distance can be important in directed output measurement. See Figure 6:

**Figure 6. OP295/OP296/OP297 Relative Radiant Intensity vs. Angular Displacement**


5° (Total 10° included cone angle from tip of lens to aperture at standard test conditions)
5°
5°
d = 0.5"
(d = distance from lens tip to detector)
d = 1.0"
d ≥ 2.0"
RELATIVE RADIANT INTENSITY – %
θ – ANGULAR DISPLACEMENT – Degrees

It is essential that these variables be exactly specified in order for users to extract necessary information from data sheets. Separate application bulletins address the thermal behavior of LEDs (Bulletins 105 and 121) and the characteristics of GaAs and GaAlAs LEDs (Bulletin 114). Power measurement is integrally tied to the information contained in these bulletins, and even a basic understanding is difficult without understanding the information they contain.

## Parameter Definitions and Measurement Techniques

There have traditionally been two methods of defining power measurement, but there have been different interpretations for each.

The first method is radiant power output ($P_O$ or $E_e$), sometimes called total power. A strict interpretation of $P_O$ is that the total amount of radiation exiting the package in any direction should be measured. Optek has interpreted radiant power output to be only that radiation which exits the package in a direction useful to most customers. The measurement includes only that radiation collected by a flat surface detector near the lens tip and orthogonal to the lens axis. Radiation emitted from the sides or back of the package and surface reflections from the detector are not collected. Therefore, Optek devices are conservatively rated (sometimes by a factor of 2 depending on the device type) when compared to devices which are measured differently by other manufacturers. For instance, $P_O$ readings for the narrow (15° between half power points) radiation pattern OP295 are typically 60% higher when using a parabolic reflector than when using the standard Optek $P_O$ test fixture.

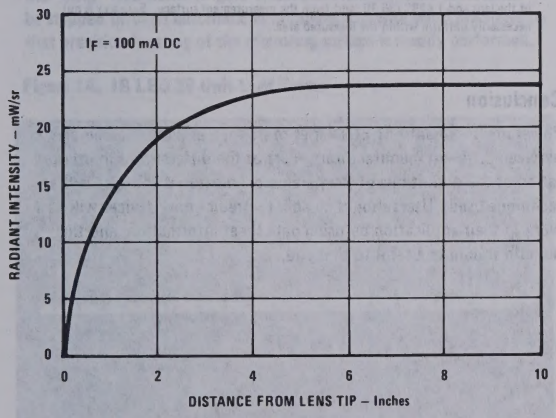
$P_O$ measurements are normally useful only for devices which have wide radiation patterns because the primary application is in providing a relatively even intensity over a large area. Radiation which

exits the side or back of the package is not useful without external reflectors; and if external reflectors are added, there are intensity peaks in the radiation pattern which are detrimental in most applications.

The second major way to measure power is on-axis intensity. This is done by measuring the power incident upon a specified area. The most common method is to provide a fixture which has a fixed distance from the device to an aperture of precisely known area which is placed in front of a detector. This measured power can then be specified as average power per unit area (both $E_{e(APT)}$ and $P_A$ are equivalent and the unit of measure is normally $mW/cm^2$) or as average power per unit cone angle ($I_e$; where the unit of measure is mW/sr).

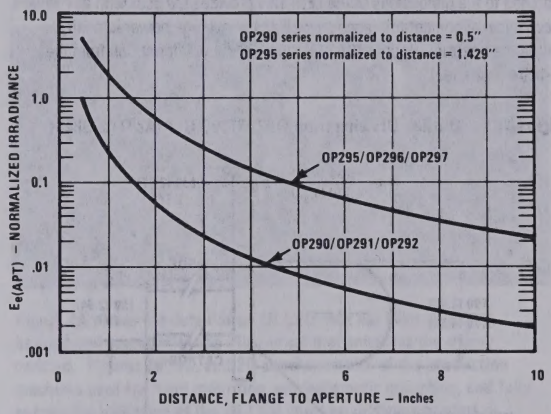
Most LEDs cannot be modeled as a point or discrete source except at distances which are very large compared to the package dimensions and/or optical dimensions. Thus, the foundation assumption in spherical calcaulations (using mW/sr) is invalid and attempts to use this model can lead to errors. Therefore, the calculated value of $I_e$ is dependent upon distance for most applications, and a design engineer can be misled by the mathematical model into assuming that $I_e$ is a constant regardless of distance. Note in Figure 7 how the mW/sr becomes consistent at approximately 6 inch separation.

**Figure 7. Output Intensity in mW/sr vs. Distance from Lens Side of Mount Flange on T–1 3/4 Package**



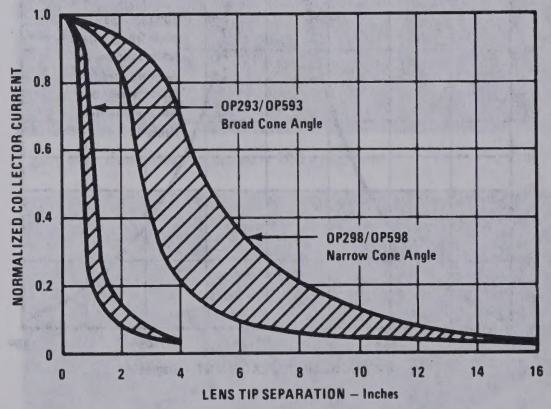

Optek has chosen to use $E_{e(APT)}$ or $P_A$ rather than $I_e$ for devices which don't have a virtual source that is distance independent. This is the preferred parameter because a simple performance graph can then show how $E_{e(APT)}$ varies with distance as shown in Figure 8.

**Figure 8. Output Intensity in $mW/cm^2$ vs. Distance from Lens Tip on T–1 3/4 Package**




$E_{e(APT)}$ measurements have historically been made only for narrow radiation pattern devices because their major application is to have a high on-axis intensity for good coupling efficiency with a small sensing area photodetector (see Figure 9).

**Figure 9. Coupling Characteristics of Plastic TO-46 Phototransistor and GaAlAs IR LED vs. Separation Between Lens Tips**




However, Optek is now using the measurement parameter with wide radiation pattern devices also. $E_{e(APT)}$ is a key design parameter when the distance and aperture are chosen to give maximum useful information. The distance is chosen so two criteria are met: first, all intensity peaks should fall within the aperture opening for devices with normal optics; and second, the distance should be at a maximum with the constraint that the intensity does not vary more than 10% from point to point within the aperture

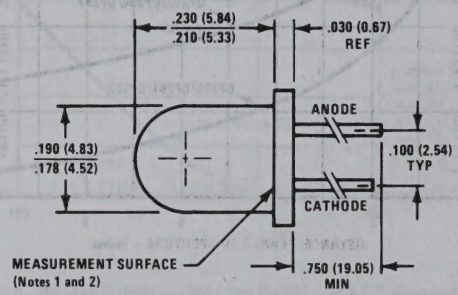
APPLICATION BULLETINS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

opening for normal devices. Aperture size is typically chosen so that it is slightly larger than the lens diameter of a detector which is mechanically matched to the dimensions of the LED. This provides the user with a mechanical alignment tolerance as well as the average power intensity within the aperture. Figures 10A,10B, and 10C show information from the T–1 3/4 data sheet.

**Figure 10A. Outline Drawing from OP293/298 GaAlAs Data Sheet**




DIMENSIONS ARE IN INCHES (MILLIMETERS)

**Figure 10B. Beam Pattern of OP293**

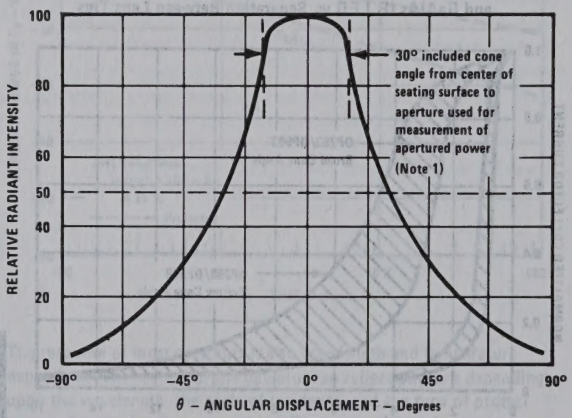
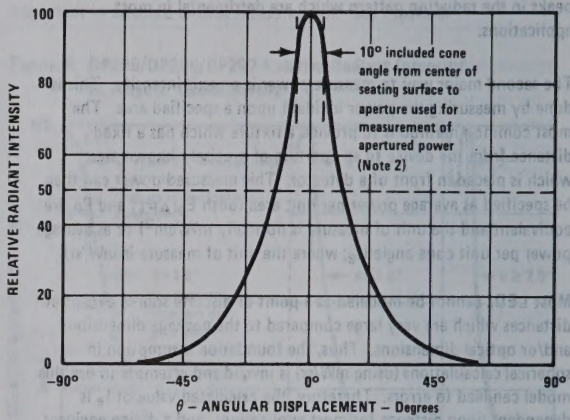



**Figure 10C. Beam Pattern of OP298**




**Notes to Figures 10A, 10B, and 10C:**

(1) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250" (6.35 mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 0.500" (1.27 mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

(2) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250" (6.35 mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 1.429" (36.30 mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

## Conclusion

Power measurement of LEDs varies more than any other parameter between different manufacturers. Part of the difference is in interpretation of the definitions of the parameters measured and part is the technique used. Users should be able to predict how devices will work in their application by using data sheet information, and this bulletin should be useful to that end.

**Kirk Bailey**

# A comparison of plastic versus metal packaging for infrared sensors and emitters.

## Introduction

Recent advances in optoelectronic packaging technology have resulted in the development of plastic infrared sensors and emitters which are in many ways superior to their metal counterparts. While the metal package is still the right choice for some applications, plastic devices offer decided advantages in cost, output power, reliability, power dissipation, and optical quality. This application bulletin will compare the two packages and show how the better performance of the plastic part is obtained.

## Cost

The lower cost of the plastic package is a result of reduced labor costs (due mainly to automation of the assembly process) and reduced materials cost. Plastic device construction lends itself to automation, and the expensively tooled piece parts characteristic of metal devices are simply not required.

Mounting the chip and attaching the bond wire are two of the most labor intensive phases in the manual assembly of optoelectronic semiconductors. The problem is especially acute for LEDs as the chips are small and relatively delicate, and they must be mounted in a reflective well to utilize their lateral emission. Automation of these processes requires extremely precise mechanical placement, which is difficult with the individual headers used in metal devices. In contrast, the "strip" lead frame (Figure 1) used in making plastic devices can be stepped through automatic chip mount and wire bond machines so that precision locating of the mounting surface is readily performed.

**Figure 1A. IR LED 20 Unit Lead Frame**

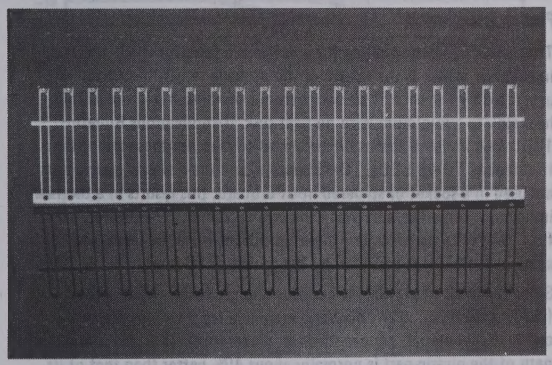


**Figure 1B. Detail Enlargement of LED Chip Mounting Area**

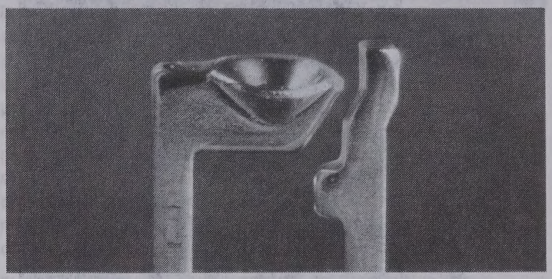


Figure 2A shows the detail of an IR LED that has been mounted, bonded and coated with the silicone gel that enhances the energy emitted. Figures 2B, 2C, and 2D show examples of the production machines used for hand mounting, semiautomatic mounting, and fully automated mounting of the IR LED chips on different headers or lead frames.

**Figure 2A. Detail of Mounted and Bonded Chip**

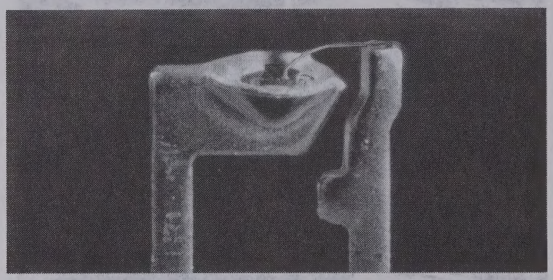
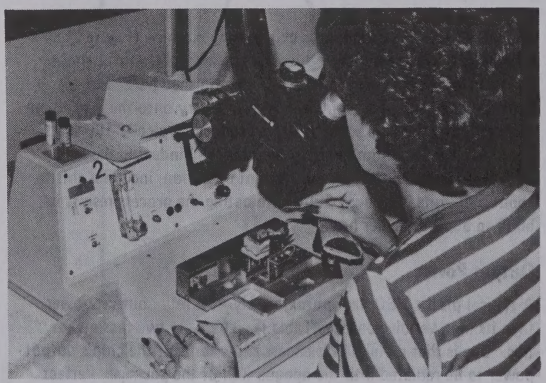


**Figure 2B. Hand Mount Station ≈ 100 units/hour**



APPLICATION BULLETINS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

**Figure 2C. Semi-automated Mount Station ≈ 500 units/hour**

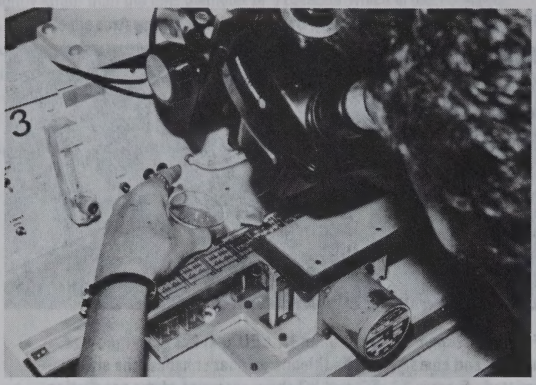
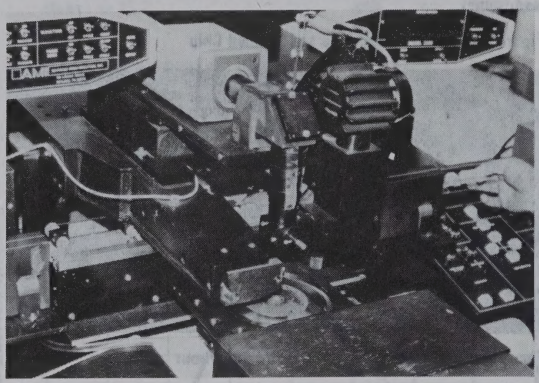


**Figure 2D. Fully Automated Mount Station ≈ 5000 units/hour**

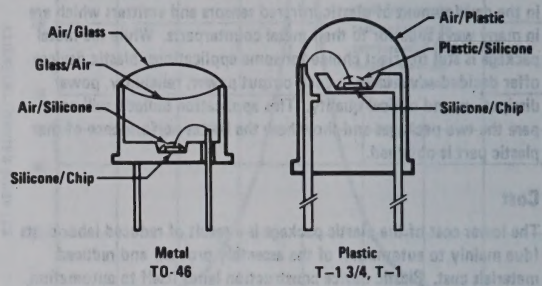


The initial cost of an automatic chip mount machine (Figure 2) or automatic bonder is high but the dramatic increase in throughput results in an overall cost reduction for the finished part. For example, manually dispensing conductive epoxy onto the lead frame and mounting the chip with tweezers produces typically 100 units per hour. Partial automation, by mechanically indexing the lead frame into position for a manual mount operation, increases this to about 500 units per hour. Fully automating the process results in 5000 to 6000 units per hour.

## Output Power

A typical plastic LED has approximately 40% more output power than its metal equivalent (see Table I). There are two reasons for this. One is that metal LED headers allow some of the chip's output power to be radiated into the opaque wall of the package. Perfect reflectivity at these surfaces is not attainable and much of this radiation is absorbed before it can escape through the lens. The other problem with the metal package is that the lens has two surfaces. Some of the optical radiation which does reach the lens is reflected back into the package and absorbed. Figure 3 shows a comparison of the optical properties of the two package types.

**Figure 3. Optical Interfaces in Metal and Plastic Packages for IR LED**




The following table shows a comparison of total output power on the metal package and the mechanically equivalent plastic package.

**Table 1. Output Power ($P_O$) in Metal and Plastic Packages @ $I_F$ = 100 mA**

| Device Type | | $P_O$ |
|---|---|---|
| Metal TO-46 | Low Range | 8.0 mW |
| | Mid Range | 10.0 mW |
| | High Range | 12.0 mW |
| Plastic TO-46 | Low Range | 12.0 mW |
| | Mid Range | 15.0 mW |
| | High Range | 18.0 mW |

## Power Dissipation

The power dissipation rating for a device is a function of its thermal impedance, which is the ability of the package to get rid of heat generated by the chip. This varies from a maximum with an infinite heat sink to a minimum with no heat sink. (Applications Bulletin 121 covers in detail the techniques used to measure these quantities.) In practice, TO-46 LEDs, TO-18 sensors, and their plastic equivalents are used in a socket or soldered in a PC board; this results in a thermal impedance somewhere between the two extremes. The primary heat flow path for a device under these conditions is via the leads, and some heat sinking is provided by the socket or PC board.

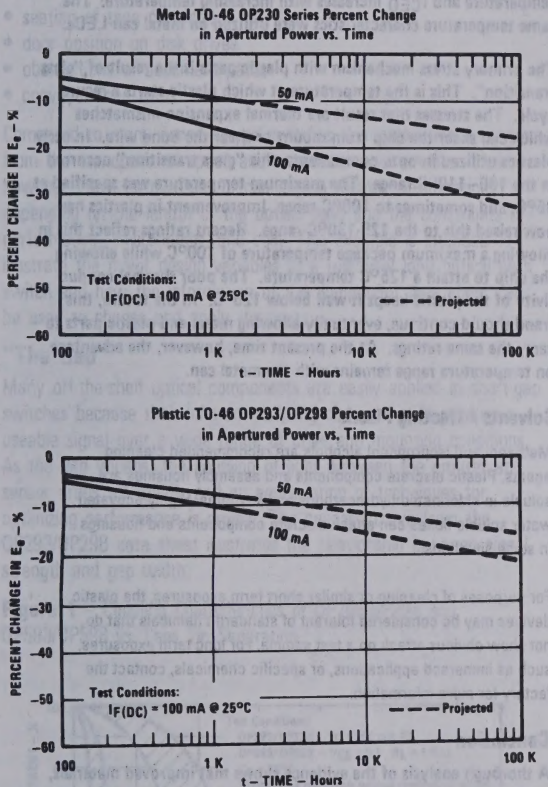
Since the leads of plastic devices have a larger cross-sectional area (.020" x .020" vs. .017" dia.) and are made from a more thermally conductive material (copper-silver vs. nickel-iron alloy), the thermal path of the plastic part is normally about 40% better than that of its metal equivalent. This results in significantly improved power dissipation ratings for the plastic part. Infinite heat sink ratings will show the metal part to be equal or superior since these ratings take advantage of the better thermal conductivity of the metal package body; however, since a heat sink is rarely used, the plastic part usually offers better thermal performance.

OPTEK

## Reliability

In optoelectronic technology the two main reliability considerations are long term LED degradation and catastrophic failure of LEDs or sensors due to thermal and mechanical stress. In the case of long term LED degradation, the plastic device has a definite advantage due to its improved power dissipation characteristics and the lower junction temperatures which result. Figure 4 shows life test data for the metal OP231 and the plastic equivalent OP298 operated at 100 mA.

**Figure 4. Operating Life Test Data on Metal and Plastic TO-46 Packages**



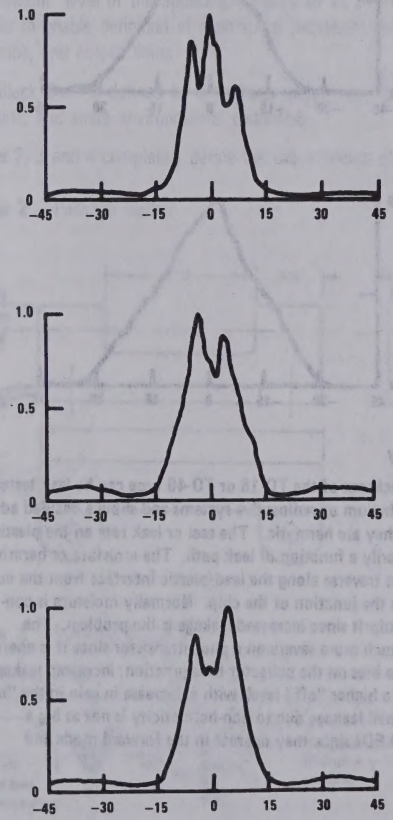

Catastrophic failure due to thermal or mechanical stress, which usually occurs early in the operating life of a device, results from forces on the chip or bond wire which can dismount or delaminate that chip, disconnect the wire bond, or break the bond wire. The design of the metal part gives it the advantage here as there are no such forces on the chip or bond wire. However, the machine fabrication of the plastic part is very repeatable and mechanically accurate so that there are fewer failures due to assembly variables. In the end, neither part has a clear cut advantage with respect to catastrophic failures.

## Optical Quality

Lens performance is especially important for LEDs and in this respect the plastic part is distinctly superior. The automated chip placement is a contributing factor since inaccurate placement of the LED chip in its reflective well can cause power loss and a deviation between the optical and mechanical axes of the finished part. However, the most significant factor is the lens itself. In the plastic lens there is only one surface, which is controlled by the precisely machined and polished surface in which it is cast or molded. The glass lens used in metal packages is flame polished from a molded glass pellet, and the resulting lens exhibits variations in focal length and surface curvature so that the radiation pattern of the finished part is difficult to control. Figure 5 shows typical radiation patterns for OP131/OP231 metal parts and OP293 plastic parts. This illustrates the improved consistency of the plastic lens.

**Figure 5. Radiation Patterns on Metal and Plastic TO-46 Packages**

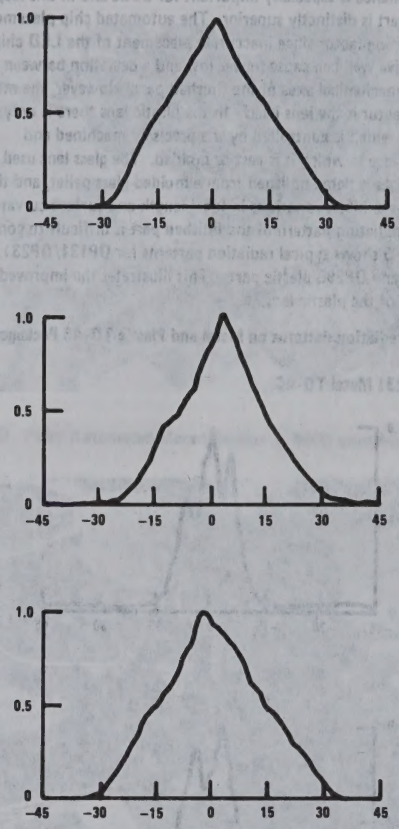
**OP131/OP231 Metal TO-46**




APPLICATION BULLETINS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

**OP298 Plastic TO-46**




## Hermeticity

The metal packages of the TO-18 or TO-46 type can be leak tested utilizing the helium or radioactive systems and show a decided advantage in that they are hermetic. The seal or leak rate on the plastic parts is primarily a function of leak path. The moisture or harmful material must traverse along the lead/plastic interface from the outside world to the junction of the chip. Normally moisture is considered the culprit since increased leakage is the problem. The problem is much more severe on a phototransistor since it is operated with a reverse bias on the collector-base junction; increased leakage will result in a higher "off" level, with a decrease in gain in the "on" level. The small leakage due to non-hermeticity is not as big a problem on LEDs since they operate in the forward mode and increased leakage will appear as a very slight reduction in energy transmitted. Metal units offer an advantage in hermeticity. This primarily pertains to the receiver or sensor and is not a major factor in the LED.

## Temperature Range

The normal temperature range for metal can type parts has been set from −55°C to +150°C. These limits are somewhat arbitrary but will satisfy what is required. They primarily come from limitations in a silicon transistor in that $h_{FE}$ decreases with decreasing temperature and $I_{CEO}$ increases with increasing temperature. The same temperature characteristics were utilized on metal can LEDs.

The primary stress mechanism with plastic parts is the result of "glass transition". This is the temperature at which plastic starts a recure cycle. The stresses that result are thermal expansion mismatches which can shear the chip from mount or shear the bond wire. In early plastics utilized in opto components, this "glass transition" occurred in the 100–110°C range. The maximum temperature was specified at 85°C, and sometimes to 100°C range. Improvement in plastics has now raised this to the 125-130°C range. Recent ratings reflect this in allowing a maximum package temperature of 100°C while allowing the chip to attain a 125°C temperature. The poor thermal conductivity of the plastic keeps it well below 125°C. In the future, this trend should continue, eventually allowing metal and plastic parts to carry the same ratings. At the present time, however, the advantage on temperature range remains with the metal can.

## Solvents Affecting Plastic

Methanol and isopropanol alcohols are recommended cleaning agents. Plastic discrete components and assembly housings are soluble in chlorinated hydrocarbons and keynotes. Highly activated water soluble fluxes can attack discrete components and housings in some situations.

For purposes of cleaning or similar short term exposures, the plastic devices may be considered tolerant of standard chemicals that do not show obvious attack on a test sample. For long term exposures, such as immersed applications, or specific chemicals, contact the factory for more information.

## Conclusion

A thorough analysis of the evidence shows that improved materials, processes, and automation give plastic housings a decided advantage over their metal counterparts for opto sensors and LEDs in most applications. Their use can reduce costs, provide improved reliability through longer life, and offer increased infrared power output. In summary, the plastic packages represent a significant technological advantage over their metal can predecessors.

**Martin McCrorey**

OPTEK

# Designing a "Wide-Gap Optical Switch" using an OP293/OP298 (plastic TO-46 equivalent) LED and OP593/OP598 (plastic TO-18 equivalent) phototransistor.

## Introduction

The application described here is commonly referred to as "object presence" sensing. It is the use of a single pair of active components, (LED and sensor) to sense the interruption of an optical path by an "opaque" object. This type of beam interrupt switch is applied in industrial controls and computer peripherals to signal:

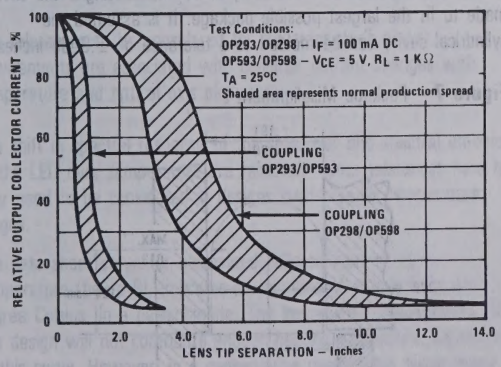
- seating of tape cartridge
- door position on disk drives
- obstructions of document paths
- conveyor feed rates

Compared to many encoder type switches this application is simpler from the standpoint of speed and resolution requirements. It can, however, have its own set of challenging design considerations depending on the length of the optical path and the constraints of performance, environment, and cost. This example is intended to illustrate the major design variables of a relatively long optical path switch and how the information of the component data sheet can be used to choose and apply the parts.

## "The Gap"

Many off-the-shelf optical components are easily applied in short-gap switches because their inherent coupling characteristics produce a useable signal over a wide range of drive and mounting conditions. As the gap widens, the coupling of light between the emitter and sensor drops off rapidly and an appreciation of techniques for optimizing performance is critical. The coupling curve from the OP293/OP298 data sheet illustrates the relationship between signal strength and gap width.

**Figure 1** – Coupling Characteristics of OP293/OP298 and OP593/OP598 vs. Lens Tip Separation




The more rapid decrease in coupling vs. distance of the OP293/OP593 pair is due to the differences in package lenses which produce a wider beam angle.

Other package types have similar coupling curves, most decreasing with distance more rapidly than this family of parts. The OP298/OP598 pair will be used for the example because of the superior coupling at longer distances.

All the performance optimizing techniques are tied to the clear definition of system constraints and minimizing both electrical and mechanical tolerances.

## "Black Box"

The "system" level of the application should be as clearly defined as possible to enable definition of mechanical tolerances, ambient conditions, and output limits.

The "Black Box" is defined by a package outline, an electrical schematic and some environmental conditions.

Figures 2, 3 and 4 completely define the requirements of the system.

**Figure 2** – Package Outline

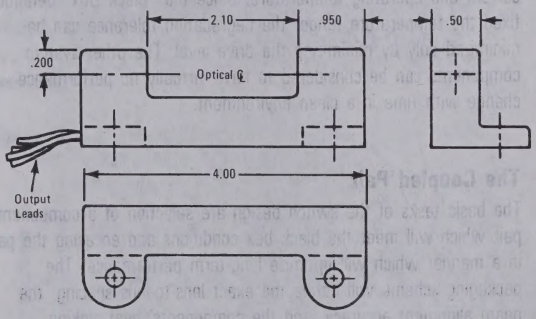
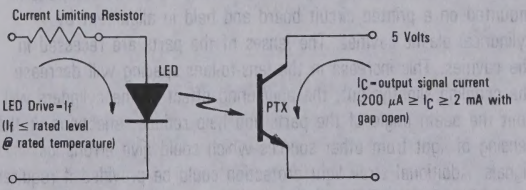



**Figure 3** – Schematic/Drive




APPLICATION BULLETINS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

**Figure 4** – Operating Conditions

| | |
|---|---|
| Operating Temperature Range | (0°C to 55°C) |
| Voltage Supply Tolerance | (±10%) |
| Required Operating Life | 50K Hours |

Other ambient conditions: To simplify the example, assume a relatively clean environment and one in which ambient light conditions will not produce errors in the output signal. Both of these conditions can be addressed with filters over the devices and additional performance tolerances.

## Basic Guidelines

To ensure that the system will work over the full range of operating conditions and will also be manufacturable, some trade-offs and tolerances must be introduced. As with every other circuit, the performance variations versus temperature, life, and supply voltage are considered. The optically coupled circuit has the additional tolerance associated with the beam alignment of the LED and sensor.

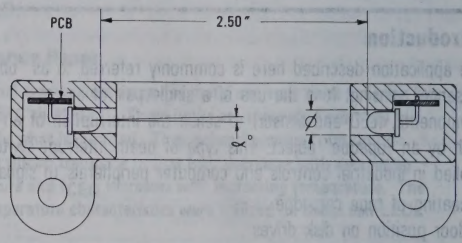
Oftentimes the single largest tolerance of the optical (infrared) switch design is associated with the degradation of LED power output over time. By nature, the efficiency of either GaAs or GaAlAs LEDs decreases with use and is directly proportional to both drive current and operating temperature. Since the "Black Box" definition fixed the temperature range, the degradation tolerance can be minimized only by minimizing the drive level. The other system components can be considered to have virtually no performance change with time in a clean environment.

## The Coupled Pair

The basic tasks of the switch design are selection of a component pair which will meet the black box conditions and encasing the pair in a manner which will optimize long-term performance. The packaging scheme will define the exact lens-to-lens spacing, the beam alignment accuracy, and the components' heat sinking conditions that dictate power dissipation.

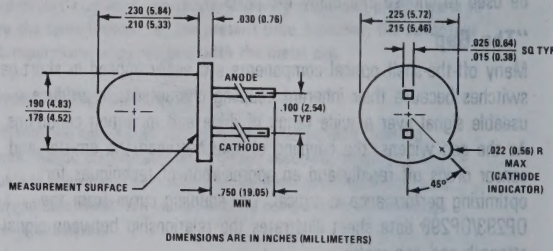
Figure 5 shows a section view of the switch with the components mounted on a printed circuit board and held in alignment by cylindrical plastic cavities. The lenses of the parts are recessed in the cavities. This increase in the lens-to-lens spacing will decrease the coupling slightly; but, the aperturing effect of the cylinders will limit the beam angle of the parts and help reduce reflections or the sensing of light from other sources which could give erroneous signals. Additional stray light protection could be provided if required by making changes in interfering surfaces or by aperturing.

**Figure 5** – Mechanical Design




The mechanical alignment of the components will depend primarily on three tolerances, (1) the diameter of the LED and sensor package, (2) the diameter of the cylindrical cavities, and (3) the straightness or flatness of the housing which maintains the beam axis.

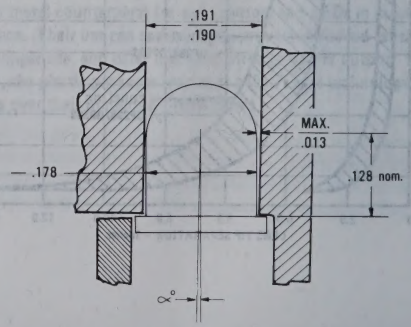
**Figure 6** – Package Tolerance




DIMENSIONS ARE IN INCHES (MILLIMETERS)

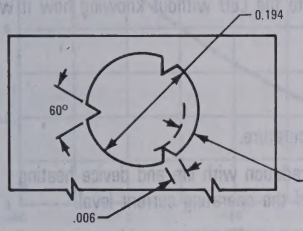
From the data sheet of the OP298 and OP598 (figure 6), the discrete package tolerance is ±.006 inches for both LED and sensor. Figure 7 shows the possible beam misalignment attributable to the worst case dimensions of the component and housing if the cavity is made to fit the largest possible package. It is assumed the cylindrical cavity can be molded to a tolerance of ±.0005 inches.

**Figure 7** – Package Misalignment



In practice, an improvement can be made on the fit of the components by introducing details in the cavities which make use of the plastic's flexibility. Even with glass filled material, the addition of small ribs along the cavity walls will hold the smaller diameter components in better alignment and can compress to allow a press fit of the larger parts.

**Figure 8** – Tightening Ribs




The tightening ribs shown in figure 8, reduce the diameter mismatch to (.184 – .178) = .006 max. reducing the optical axis displacement to:

$$\tan^{-1}\frac{.006}{.128} \approx 2.9°$$

The misalignment associated with curvature of the housing will depend on the method of construction; however, for a molded plastic housing of this size it would be fair to assume a flatness of .005 inch. Over the optical path of (2.50 inches) this warp should not contribute more than $\approx \tan^{-1}\frac{.005}{2.50} \approx .11°$ shift off axis. With this addition to the shift from the cavity tolerance, it can be assumed the LED or sensor could be misaligned as much as four degrees (3°).

## Power Requirements

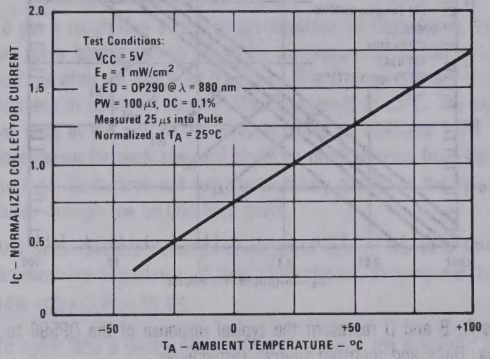
The ratings of the OP598 are given in terms of milliamps (mA) of collector current when irradiated by a tungsten source of 5 mW/cm² and supply voltage of 5 volts. The data sheet characteristics, together with the "black box" constraints, enable calculation of the power required from the LED.

The tolerances to be considered for the transistor's power requirements are associated with collector current changes with temperature and optical axis alignment.

The shift in spectral response of the transistor and spectral emission of the LED over temperature are relatively minor tolerances here but may need to be considered in designs with broader temperature ranges.

The data sheet curve for normalized collector current vs. temperature (figure 9), indicates an increase of one percent per degree Celsius, in a pulsed mode. The low current requirements of this design will not contribute enough heating to warrant adjustments to this curve. However, in a conservative design, this temperature characteristic should not be used as a factor that completely compensates for the opposite temperature effect of the LED. The temperature sensitivity is dependent on the transistor's electrical gain and can vary significantly. The curve can be used as a worst-case tolerance, (25%) at the low temperature of this design.

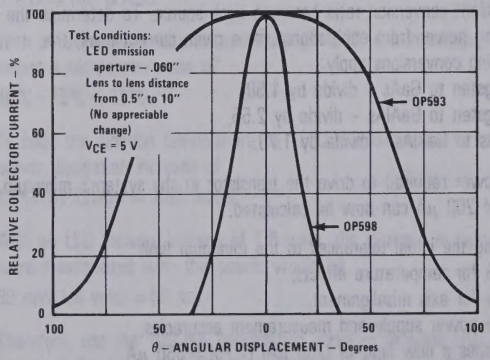
**Figure 9** – Normalized Collector Current vs. Ambient Temperature




The worst-case optical axis misalignment has already been calculated to be four degrees (3°). Its effect can be estimated from the curve of normalized collector current vs. angular displacement, figure 10. The narrow beam of the OP598 makes the part more sensitive than the OP593 to misalignment (dropping ≈ 15%) but this does not outweigh the rated performance advantage of more than two to one.

In contrast to many hermetic devices, the molded optics of the OP598 is very consistent. The beam pattern graph, therefore, accurately represents performance and requires no additional tolerancing.

**Figure 10** – Normalized Collector Current vs. Angular Displacement



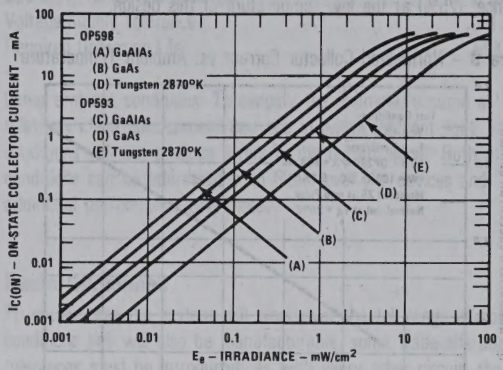

To find the basic radiant power requirement, the data sheet's tungsten test rating must be converted to one which reflects the transistor's sensitivity to the GaAlAs emission of the OP298. Figure 11 shows how the collector current varies with power intensity and the type of source used.



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

**Figure 11** – OP593/OP598 $I_C$ vs. Irradiance




Curves A, B and D represent the typical response of the OP598 to GaAlAs, GaAs and tungsten sources respectively.

Curves C, D and E show the OP593 collector current variation vs. power for each source.

The tungsten response curve of the OP598 (curve D), intersects the irradiance level of 5 mW/cm² at a current level of between seven and eight milliamps. This curve, therefore, reflects the minimum response of the highest range part (OP598A), or the middle of the rated response range for the OP598B. Direct calculation from the data of the curve, therefore, will insure performance estimates that are representative of a relatively wide distribution of the available components.

The parallel relationship of these curves can be translated into a convenient conversion ratio between each source. To determine the required power from each source for a given current level, the following conversions apply:

- tungsten to GaAs – divide by 1.50,
- tungsten to GaAlAs – divide by 2.55,
- GaAs to GaAlAs – divide by 1.70.

The power required to drive the transistor at the system's minimum limit of 200 $\mu$A can now be calculated.

Applying the initial tolerances to the minimum limit

- 25% for temperature effects,
- 15% for axis misalignment,
- 10% power supply and measurement accuracies,

establishes a new limit of (200 $\mu$A) (1.75) = 350 $\mu$A.

The curve of figure 11 for tungsten intersects 350 $\mu$A at a radiant power level of about 250 $\mu$W/cm².

Applying the conversion factor for GaAlAs, the power requirement is reduced to approximately 100 $\mu$W/cm², which corresponds closely to the top curve of figure 11.

## LED Drive

The ratings for the OP298 LED, like that of the OP598, establish performance limits at one set of conditions. The calculated power requirement of the transistor, together with the data sheet information, will be used to determine the minimum drive current for the OP298.

Tolerances we can apply to the LED without knowing how it will be operated, include:

- coupling vs. gap width,
- $I_f$ vs. supply tolerance,
- axis misalignment,
- effects of ambient temperature.

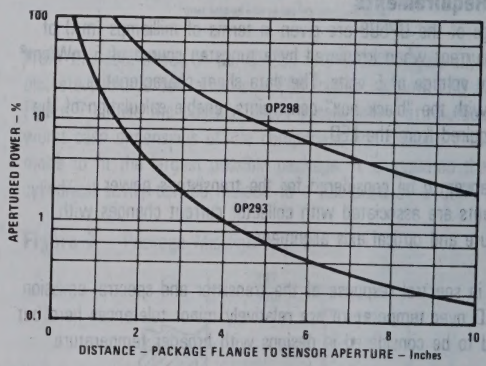
The effects of power degradation with life and device heating require some knowledge of the operating current level.

Figure 12, Normalized Power vs. Distance, provides a conversion factor from the data sheet test distance to the applications gap distance. Since the curves reflect the spacing from the sensor to the LED flange, add the package length of .22 inches to the optical path length of 2.50 inches for conversion.

At the distance of 2.72 inches, the OP298 retains about 30% of its rated power intensity. The similarity in size between the data sheet aperture (.25") and the applications sensor diameter should make this conversion very accurate.

It is obvious from this figure why the narrow beam OP298 was chosen over the wider beam OP293. With the gap separation of this system, the OP293 retains only 2.5% of its rated power.

**Figure 12** – Normalized Power vs. Distance

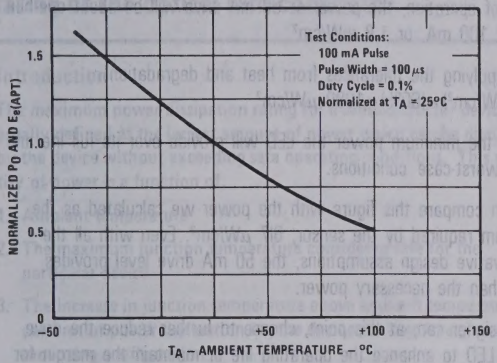



Assuming the LED current will be controlled by the five (5) volt supply and a limiting resistor, a notable tolerance results. Even with a quality resistor, the variation of the LED's forward voltage vs. current can produce a 15% drive current tolerance for a 10% voltage supply tolerance.

The axis misalignment from the mechanical design has been calculated to be 3° worst case. As with OP598, the effect on coupling will be in the range of 15%.

The system's ambient temperature range contributes a power tolerance of 25% at the upper limit of 55°C, as shown in figure 13.

**Figure 13** – Normalized $P_O$ and $E_{e(APT)}$ vs. Ambient Temperature




With these tolerance factors (15% axis misalignment; 15% power supply tolerance; and, 25% ambient temperature limit) and the power requirement of 100 $\mu W/cm^2$, the data sheet ratings can now be used.

Taking the initial estimate of power required by the sensor (100 $\mu W/cm^2$), we can apply these first tolerances.

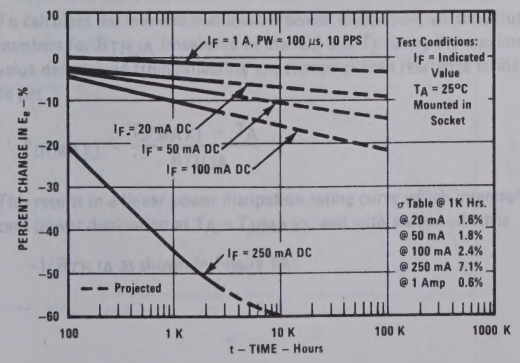
$100\ \mu W/cm^2 \times (85\% \times 85\% \times 75\%)^{-1} = 100\ \mu W/cm^2 \times (1.85) = 185\ \mu W/cm^2$

This is the amount of power intensity which would be required at the data sheet's test distance of 1.425 inches. As was shown on figure 12, an IRLED at the designed gap would have only 30% of power measured at 1.425 inches. To convert for this 70% drop with distance, divide by 0.3. Thus

P min @ (2.75") = 617 $\mu W/cm^2$

Referring to figure 14, it is evident from the curves of "Apertured Power Output vs. Time" that regardless of drive level, some decrease in available power must be accommodated as the unit is operated. To minimize this degradation effect, it will be important to select the lowest useable drive.

**Figure 14** – Percent Change in Apertured Power Output vs. Time




In another application with more demanding temperature requirements or less available heat sinking capacity, the upper limit of the LED drive may be dictated by the power dissipation rating. Note 1 of the data sheet shows, however, that the maximum continuous current can be applied up to 62.5°C with PC board heat sinking.

To get a rough idea of the design tolerance for degradation, follow the curve labeled 50 mA DC to the intersection at 50,000 hours (or approximately six years) of operation. The average unit will show a decrease in power of roughly 14% if operated at 25°C. The sigma ($\sigma$) table at the side of the curve indicates an additional 1.8% degradation for each standard deviation of distribution from this average. Each curve will run approximately parallel to the average curve through the 50,000 hour point.

Add three standard deviation percentages ($3\sigma$) to the 14% to estimate the degradation of the full distribution of components.

$14\% + (3) \times (1.8) = 19.4\%$

To again take a conservative approach, assume the average temperature is 40°C rather than the 25°C illustrated by the curves of figure 14.

Characteristic data has shown that less degradation will occur from conditions of low current/high temperature than from high current/low temperature. Therefore, use the later condition as a model for the former and build in some safety factor. It should be kept in mind, however, that making degradation calculations with a higher current model is a very conservative approach, especially when working from the minimum ratings of the device.

From the thermal parameters of the OP298 data sheet, find the "normal" heat sinked thermal resistance of

$R_{THJA} = 188°C/Watt$.

With an average ambient temperature of 40°C, it is necessary to reflect a temperature rise of

$40°C - 25°C = 15°C$.

To raise the junction temperature by 15°C it is necessary to have a power dissipation increase of

$15°C/188°C/watt \approx .080$ watts.

With an LED forward voltage of 1.6 volts, the increase in forward current associated with this power would be

80 mW/1.6 volts = 50 mA.

Therefore, use the 100 mA degradation curve to simulate the system if the average ambient temperature is 40°C and the drive current is 50 mA.

At the 50,000 hour point, the 100 mA curve shows an average degradation of 20% and each standard deviation produces an additional 2.4%.

APPLICATION BULLETINS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

For the full distribution of components, therefore, the maximum degradation should be 20% + (3) (2.4%) = 27.2%.

An additional temperature related power tolerance needs to be included in the calculation which will enable the conversion from the pulsed power rating at 25°C to a direct continuous current rating at the upper operating limit of 55°C.

Refer to the curve of figure 13, "Normalized Apertured Power vs. Temperature," and the thermal resistance rating to make this conversion.

Choosing again an operating point of 50 mA and noting that the worst-case forward voltage is 2.0 volts, the maximum power dissipation would be
$P_d = (.050)\ (2.0) = .100$ watts.

Using the thermal resistance of 188°C/watt, the temperature rise of the junction would be
$T_{JA} = (.100)\ (188°C) = 18.8°C$.

It can be assumed that this junction temperature rise at an ambient temperature of 25°C and 100 mA DC would have essentially the same effect as an ambient rise of 18.8°C in the pulsed condition.

From the curve of figure 13, we can see the effect is to reduce the available power by approximately 18%.

Combination of all these tolerances allows calculation of a drive level which accommodates six years of continuous operation over the full temperature range. Adding these tolerances, 27.2 percent for degradation, and 18 percent for junction temperature rise indicates that at least 60 percent of the initial power will be available at "end of life."

The baseline power must first be calculated at the selected drive level of 50 mA using the minimum ratings of the data sheet.

**T. E. Eichenberger**

IRLED is rated at 3.6 mW/cm² with a drive of 100 mA. Since the relationship between current and power is relatively linear in this range of operation, the power at 50 mA drive will be about one-half that at 100 mA, or 1.8 mW/cm².

Then applying the tolerances from heat and degradation
$(1.8\ mW/cm^2) \times (60\%) = 1080\ \mu W/cm^2$

This is the minimum power the LED will provide over its full life and under worst-case conditions.

We can compare this figure with the power we calculated as the minimum required by the sensor, 617 $\mu W/cm^2$. Even with all the conservative design assumptions, the 50 mA drive level provides more than the necessary power.

The designer can, at this point, choose to further reduce the drive of the LED to enhance the operating life or maintain the margin for the sake of broadening the distribution of useable components. This can oftentimes be a cost consideration since price is usually directly proportional to power rating.

## Conclusions

It should be kept in mind that throughout these calculations, most worst-case conditions were applied simultaneously, resulting in a very conservative design. The example shows that under certain conditions these components can be easily applied in switches which span several inches without straining the limits of performance.

The narrow beam components OP598/OP298 in particular are applicable in a wide range of configurations.

**The successful design engineer has a clear understanding of the thermal impedance of the optical semiconductor. This understanding allows reliable system design that encompasses the dissipation rating of the optical semiconductor.**

## Introduction

The maximum power dissipation rating for a semiconductor device is usually defined as the largest amount of power which can be dissipated by the device without exceeding safe operating conditions. This quantity of power is a function of:

1. Ambient temperature
2. The maximum junction temperature considered safe for the particular device
3. The increase in junction temperature above ambient temperature per unit of power dissipation for the device package in a given mounting configuration

Item 3 is called thermal impedance and is determined in the lab with techniques such as those described in this bulletin. Item 2 is determined from reliability experiments and is usually considered to be 150°C, although it may be lower due to temperature limits imposed by the package material. Item 1 results in lower power dissipation ratings at higher ambient temperatures as described by derating curves, also described in this bulletin.

## Thermal Impedance Calculations

The formula for calculating thermal impedance is

$$R_{THJA} = \frac{T_J - T_A}{P_D}$$

where: $R_{THJA}$ = thermal impedance, junction to ambient (also called $\theta_{JA}$); units are $\frac{°C}{Watt}$

$T_J$ = junction temperature of the device under test
$T_A$ = ambient air temperature
$P_D$ = device power dissipation

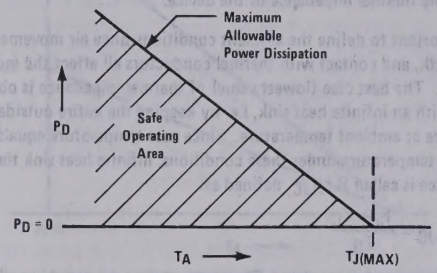
$R_{THJA}$ refers to the thermal impedance of a device with no heat sink, suspended in still air on thermally non-conductive leads. This is the worst case (highest value) for thermal impedance.

To calculate the maximum allowable power dissipation, we substitute numbers for $R_{THJA}$ (measured in the lab) and $T_J$ (using the maximum value determined from reliability experiments) then rearrange terms to get

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_A}{R_{THJA}}$$

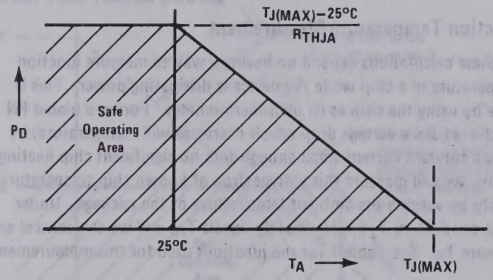
This results in a linear power dissipation rating curve which intercepts zero power dissipation at $T_A = T_{J(MAX)}$, and with a slope which is $-1/R_{THJA}$ as shown in Figure 1A:

**Figure 1A. Initial Thermal Derating Curve**



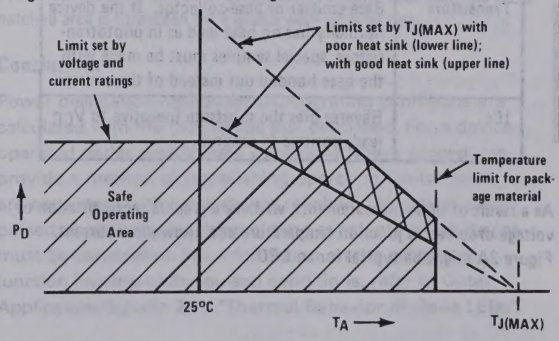

The usual (and conservative) method of rating power dissipation is to limit the curve to the safe value for normal room temperature, which is 25°C. The result is a curve shaped like Figure 1B:

**Figure 1B. Thermal Operating Curve from 25°C**




Since there are voltage, current, and ambient temperature limitations which are not related to chip temperature, the final power dissipation rating curve (often called a "derating" curve) for a given device might look like the curve shown in Figure 1C:

**Figure 1C. Final Thermal Derating Curve**




APPLICATION BULLETINS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Since thermal impedance is very nearly constant for different levels of power dissipation, we merely have to measure the junction temperature at a known quantity of power dissipation, then substitute into the right side of the formula:

$$R_{THJA} = \frac{T_J - T_A}{P_D}$$

to find the thermal impedance of the device.

It is important to define the ambient conditions since air movement, lead length, and contact with thermal conductors all affect the measured $T_J$. The best case (lowest value) of thermal impedance is obtained with an infinite heat sink, i.e. by keeping the entire outside of the device at ambient temperature. Since case temperature equals ambient temperature under these conditions, infinite heat sink thermal impedance is called $R_{THJC}$, defined as:

$$R_{THJC} = \frac{T_J - T_C}{P_D}$$

where $T_C$ = case temperature. The worst case encountered in real applications involves a device with full-length leads, mounted in a socket with no air movement. Thermal impedance under these conditions is called $R_{THJX}$ and is calculated using the same formula as $R_{THJA}$. $R_{THJX}$ is used to calculate actual worst case derating curves.

## Junction Temperature Measurement

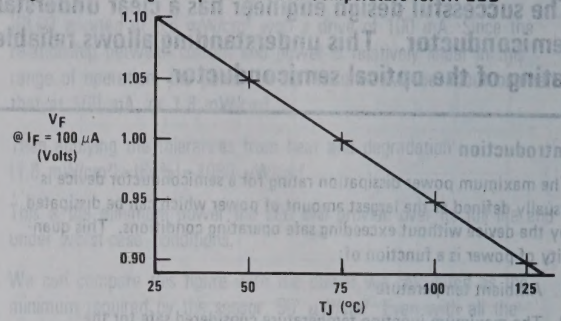
All these calculations depend on having a way to measure junction temperature in a chip while the device is dissipating power. This is done by using the chip as its own thermometer. Forward biased PN junctions have a voltage drop which decreases with temperature; by using a forward current small enough that no significant chip heating occurs, we can measure this voltage drop at known chip temperature simply by varying the ambient temperature of the package. Under these conditions, $T_J$ approximately equals $T_A$, and we can control and measure $T_A$. See Table 1 for the junctions used for this measurement.

**Table 1. Junctions Used for Measuring Temperature – $T_J$**

| Device Type | Junction Biased |
|---|---|
| LEDs, Diodes | Anode to Cathode |
| Transistors | Base-emitter or base-collector. If the device normally has no base lead as in phototransistors, special samples must be made with the base bonded out instead of the emitter. |
| ICs | Reverse bias the substrate (negative to $V_{CC}$ lead, positive to ground). |

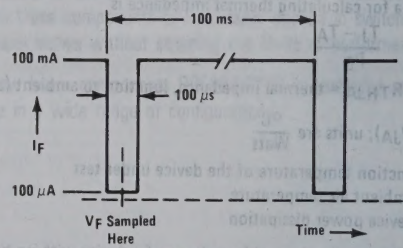
As a result of these measurements, we have a graphic representation of voltage drop versus junction temperature at a known low current. Figure 2A might be typical for an LED:

**Figure 2A. Voltage Drop vs. Junction Temperature for IR LED**



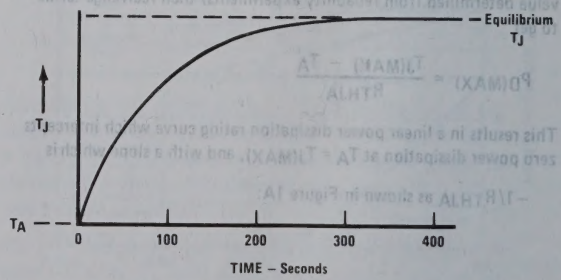

Now to find $R_{THJA}$, $R_{THJX}$, or $R_{THJC}$ we place the device in the desired mounting configuration and apply a specific amount of power dissipation to the device, sufficient to provide significant chip heating. The junction temperature is monitored by interrupting the power and substituting the low forward bias current (our "thermometer"), 100 μA for the LED described in Figure 2A. The voltage drop must be measured before the junction has time to cool significantly. We use a 100 μs interruption which is consistent with the thermal time constant of the devices being measured; a sample and hold circuit maintains the reading so it can be recorded with a voltmeter. The applied waveform for the above LED would appear as shown in Figure 2B:

**Figure 2B. Timing Cycle for Device Heating and Monitoring of Junction Temperature**




Because of the sample and hold circuit, the voltmeter reading reflects the junction temperature of the chip as shown graphically in Figure 2A. For a typical plastic LED, the temperature rises after application of DC power for several minutes as shown in Figure 2C.

**Figure 2C. Equilibrium of Junction Temperature**



When the voltmeter reading has stopped changing, we (1) substitute the reading back into the graph to get the actual $T_J$; (2) multiply the large forward current, in this case 100 mA, by the voltage drop on the diode with 100 mA applied, to get the power dissipation; (3) measure the actual $T_A$; and (4) substitute into the $R_{THJA}$ formula to get a value for thermal impedance.

## Example

A typical OP290 infrared emitting diode is found to have $V_F$ characteristics as shown at an $I_F$ 0f 100 $\mu$A:

| $T_A$ (°C) | $V_F$ (Volts) |
|---|---|
| 25 | 1.080 |
| 50 | 1.030 |
| 75 | 0.980 |
| 100 | 0.930 |

It is then connected to a test circuit and immersed in agitated silicone dielectric fluid at a temperature of 25°C; this is a good approximation of an infinite heat sink for a low power device. An $I_F$ of 100 mA is applied. Every 100 ms the $I_F$ is reduced to 100 $\mu$A for a period of 100 $\mu$s, after which the $I_F$ returns to 100 mA. Using a sample and hold circuit we observe that the $V_F$ of the device during the low current intervals starts out at 1.080 Volts but rapidly decreases, eventually stabilizing at 1.050 Volts. Interpolating between 1.080 Volts (25°C) and 1.030 Volts (50°C) we find that junction temperature is now 40°C.

The $V_F$ is measured during the 100 mA $I_F$ period and found to be 1.50 Volts. Thus, the power dissipation is 150 mW (99.9 percent of the time). Substituting into the formula,

$$R_{THJA}\text{ (infinite heat sink)} = R_{THJC} = \frac{40-25}{.150} = 100°C/W$$

When the same test is conducted with the device in still air, mounted in a PC board socket, the final values of $V_F$ are 1.024 at 100 $\mu$A and 1.40 at 100 mA. Thus $T_J$ = 53°C and

$$R_{THJX} = \frac{53-25}{.140} = 200°C/W$$

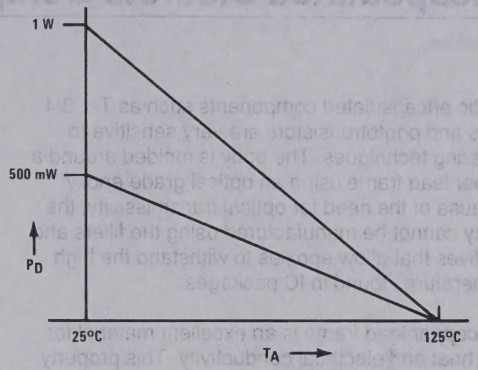
The power derating curves are:

$$P_D = \frac{T_{J(MAX)} - T_X}{R_{THJA}} = \frac{125 - T_A}{100} \text{ with infinite heat sink , and}$$

$$P_D = \frac{125 - T_A}{200} \text{ with no heat sink.}$$

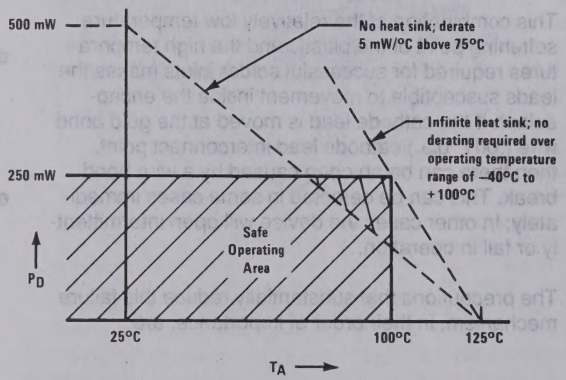
Graphing the derating curve gives two lines as shown in Figure 3A:

**Figure 3A. Thermal Derating for "Infinite" and "No" Heat Sink**




But the device is limited to 250 mW for reliability reasons, and the plastic package can withstand only 100°C due to the glass transistion temperature of the plastic. Thus, the final power derating curve is shown in Figure 3B:

**Figure 3B. Final Thermal Derating**




The entire shaded area can be used with an infinite heat sink; the cross-hatched area is forbidden for a device with no heat sink.

## Conclusions

Power dissipation ratings for DC operating conditions are calculated with the techniques just described. For a device operated under steady state conditions, these procedures provide a method of establishing operating limits which are consistent with good device reliability. However, under pulsed conditions, the thermal time constants of the device must be considered. For information on the subject of junction heating under pulsed conditions, refer to Optek Application Bulletin 200, "Thermal Behavior of GaAs LEDs".

**Martin McCrorey**

APPLICATION BULLETINS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Application Bulletin 211
July 1989

OPTEK

# Recommendations for Soldering T-1 3/4 Plastic Encapsulated Discrete Components

Plastic encapsulated components such as T-1 3/4 LEDs and phototransistors are very sensitive to soldering techniques. The body is molded around a copper lead frame using an optical grade epoxy. Because of the need for optical transmissivity, the epoxy cannot be manufactured using the fillers and additives that allow epoxies to withstand the high temperatures found in IC packages.

The copper lead frame is an excellent material for both heat and electrical conductivity. This property provides benefits such as higher allowable forward currents (therefore higher output power), which are more easily formed and bent. There is also a major disadvantage in that the heat from soldering operations is conducted inside the plastic body .

This combination of the relatively low temperature softening point of the plastic and the high temperatures required for successful solder joints makes the leads susceptible to movement inside the encapsulant. If the cathode lead is moved at the gold bond wire (.001" dia.)/cathode lead interconnect point, then there can be an open caused by a wire bond break. This can be detected in some cases immediately; in other cases the device will open intermittently or fail in operation.

The precautions that substantially reduce this failure mechanism, in their order of importance, are:

## Solder Iron

1. The overwhelming cause of failure is lead movement inside the encapsulating epoxy at the gold bond wire/cathode lead interconnect. The force exerted by the iron while the epoxy is plasticized is the critical control parameter. The smaller the force, the less likely a solder-induced open will occur. In no case should the iron exert more than 20 grams weight on the leads.

2. Keep soldering temperature as low as possible; 260°C is the maximum allowable.

3. Keep soldering time as low as possible; 5 seconds is the maximum allowable.

4. Solder as far from the package as possible. In no case should the solder joint be closer than 1/16" to the epoxy.

5. Keep leads at full length when possible and trim after soldering.

6. There are several recommended procedures or tools that can aid in the precautions listed above.

**a)** Use a heat sink between the plastic body and the solder iron.

**b)** Clamp the device leads next to the plastic body to prevent lead movement.

**c)** Load the solder onto the iron prior to making contact in order to reduce contact time.

**d)** Insure devices have not been stored for a long time in an oxidizing environment. Oxidized leads are not a severe problem, but can occur. If leads show signs of oxidation, they can be cleaned without damage to the plastic. Please call for directions.

**e)** If devices are to be inserted into PCB holes, insure the holes are at the nominal device lead spacing so there is no stress or spring tension on the leads during solder.

## Flow Soldering

1. As long as leads are not under any stress or spring tension, 260°C for ten seconds maximum will not induce failures.

2. If units need to have formed leads prior to soldering, insure forming forces the lead spacing to match the PCB hole spacing.

3. If possible, leave leads intact until after flow solder, then clip them.

**Danny Johnson**
**Kirk Bailey**

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

OPTEK

# Hall Effect Liquid Level Sensing

Have you ever had a customer that wanted to sense a liquid level? One method would be to take advantage of Snell's Law and use an optical reflective device (see Application Bulletin 204). The IR light from the LED is reflected by a conical plastic or glass surface. However, when this reflecting surface is immersed in a liquid who's index of refraction matches the plastic or glass, it will not act as a good reflector. In some cases the liquid characteristics or the operating environment will not permit the use of optical sensing. An alternative is the Hall Effect sensor. Assuming the liquid is in a non ferrous container, a small float and magnet would be placed in the liquid container as shown in Figure 1. The float must be constructed or constrained so the magnet path will be known. An OH090U, OH180U or OH360U Hall Effect sensor would then be placed on the wall just outside the container. When the float with the magnet is close enough to the Hall Effect sensor, its output will change state.

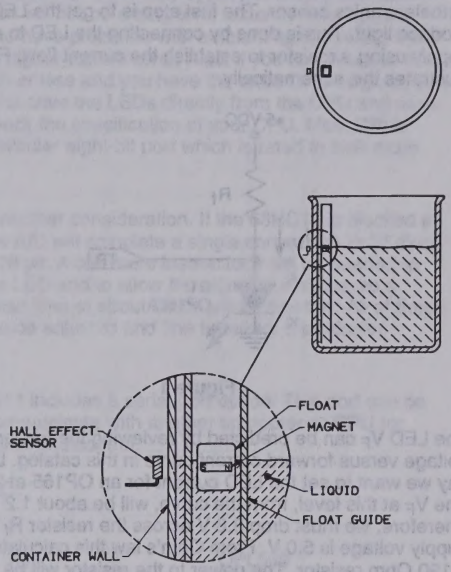



**Figure 1**

The particular sensor used will be determined by several factors. Both the strength of the magnet and the distance from the Hall Effect sensor to the magnet are critical. The designer is faced with selecting a magnet which is not affected by the liquid and sizing the magnet to produce the needed flux density cost effectively. A common magnetic material to use is Alenco 8. A magnet of this material which is .250 inch in diameter and 0.5 inches long will produce a magnetic field of 500 gauss at a distance of about 0.1 inches. An OH360U will work in this field. The exact location at which the digital sensor will activate will vary with sensor sensitivity and will change along with the magnet characteristics over temperature. The designer may want to include a means of adjusting the sensor position to move the trip point locations.

Hall Effect sensors are well suited for high temperature applications because they operate up to 150 degrees centigrade. They are also immune to dirt and other contamination if the electrical connections are protected. Also, ambient light will not be a factor as it is with optical sensors.

Liquid level sensors are used in dishwashers, washing machines, the oil and gas industry, vending machines, medical equipment, and many other places.

**Bob Stricklin**
**Technical Marketing Specialist**



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# Basic Design Ideas for Emitters and Sensors

There are some basic steps required to design-in a simple optoelectronics sensor. The first step is to get the LED to produce light. This is done by connecting the LED to a power supply using a resistor to establish the current flow. Figure 1 illustrates this schematically.

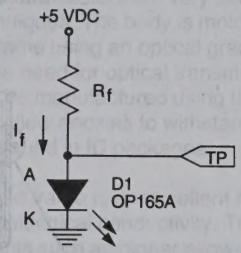



**Figure 1**

The LED $V_F$ can be predicted by reviewing the forward voltage versus forward current curve in this catalog. Let's say we want to set the LED current for an OP165 at 20 mA. The $V_F$ at this level, from the curve, will be about 1.2 V. Therefore, we must drop 3.8 V across the resistor $R_f$ if the supply voltage is 5.0 V. From Ohm's law this calculates to be a 190 Ohm resistor. The power to the resistor will be 76 mW, so a 1/8 watt or larger resistor will work in this application. To be sure everything is connected properly, measure the voltage at TP with power applied. The $V_F$ should be, as predicted, about 1.2 V. If it is 5 V, the LED is open or connected backwards, or there is a wiring error. If the voltage is 0 V, the LED is shorted, or a wiring problem may exist. At these currents, the LED output will be linear. Increase the current by 20%, the light output will increase by 20%. Ideally, the LED should be operated at a low drive current to conserve power and to minimize the effects of LED degradation. A good operating current for most applications is 20 mA.

Now that the LED is generating light, a phototransistor is used to sense it. A phototransistor functions just like a transistor except the base current is produced by an integral photodiode. Therefore, we only have to connect the collector and the emitter of the transistor. The current conducted by the transistor will be proportional to the incident light. If an OP505 phototransistor is coupled with an OP165 LED and the spacing between the lens tips is 0.2", the photo current will be greater than 1 mA. This current can be detected by using the circuit shown in Figure 2.

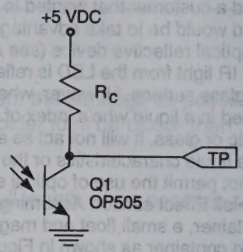



**Figure 2**

Assuming the phototransistor is operating in a saturated condition, the voltage drop across the phototransistor will be less than 0.4 V. Therefore, we must drop 4.6 V across $R_C$ when the LED is on. From Ohm's law, the resistor $R_C$ must be greater than 4600 Ohms. Therefore, a 10K Ohm resistor would be a conservative choice. This combination results in a voltage swing from less than 0.4 V to over 4.9 V when the LED is turned on and off at the test point. This is a suitable interface for a CMOS input or a voltage comparator.

There are other factors to be considered including aperture size or resolution of the sensor, effects of ambient light, switching speed and more. However, this application note is designed to assist someone who has little experience with optoelectronics.

# Interfacing Sensors with a Microprocessor

This application note addresses a method for monitoring multiple sensor channels with a single analog-to-digital channel. The application might be an eight-channel reflective or a transmissive bar code reader. By using an A/D converter an analog level of the sensor can be measured. This analog voltage can provide more information than a digital sensor.

This system would be controlled by one of the single chip microprocessors like the Motorola 68HC11. Referring to Figure 1 on the next page, let's review the details of operation. The sensors will be configured to operate one channel at a time. This is accomplished by illuminating the LEDs with a microprocessor and connecting the sensors in parallel. The LEDs will be illuminated one by one, and the resulting phototransistor current will be measured by the microprocessor analog-to-digital converter.

This type of operation consumes very little current. Each LED is only on long enough to collect a sensor reading. The microprocessor can also be programmed to have sleep periods and operate only long enough to check all the sensors. The net average current consumption would be less than 25 mA without modulating the CPU on time. This approach is ideal for applications requiring battery operation or those trying to minimize power supply requirements.

When connecting several sensors in parallel as shown, the leakage current of each sensor and its associated solder connections must be very low (200 nA). The ambient light incident on all the sensors must also be low. If these conditions are not met, the leakage currents or off currents (noise) may exceed the on current (signal). Minimizing the off state currents will also produce the greatest dynamic range for the sensing system.

The OPAMP shown is one of a CMOS series produced by National Semiconductor. It is a single supply device with an output that can be driven rail-to-rail. Any OPAMP with equivalent characteristics is acceptable. You may even find it desirable to use one with a balance adjustment which can be used to adjust OPAMP offset and any quiescent noise or leakage out of the sensing system.

Another consideration is the analog-to-digital range and resolution. If the sensor conditions vary, attempt to balance them by adjusting each LED current-limiting resistor. Keep in mind that if you have an eight-bit A/D you will have 256 different possible sensor levels. Make sure the sensor off state falls at the low end of the A/D and the on state falls near the upper end by picking good A/D reference voltages and carefully selecting the proper gain of the final amplifier or buffer. This will probably require prototyping and testing of your circuit to select the proper values.

With regard to LED current, the 7445 shown in Figure 1 is rated for operation with 80 mA of sink current. However, try to limit the LED current to about 40 mA. Normally a lower LED drive current is recommended but this system will be pulsing the LEDs at a low duty cycle, so heating and LED degradation will not be a long term factor in most applications. If you have problems with ambient light, operate the LEDs at a higher current level. Also, if you find you can work with 10 mA or less and you have the extra CPU outputs, you may want to drive the LEDs directly from the CPU and save a chip. Check the specification of your CPU. Most CPUs have a particular eight-bit port which is rated to sink more current.

Timing is another consideration. If the 68HC11 is clocked at 8 MHz, the A/D will complete a single conversion in 32 clock cycles or 16 µs. A few more instructions will be needed to turn on the LED and to allow the signal to stabilize so a channel read time of about 30 µs will be needed. All of these factors can be adjusted and fine tuned for a particular design.

The 68HC11 includes a serial port option. This port can be used to communicate with another computer or CPU for sensor status and control.

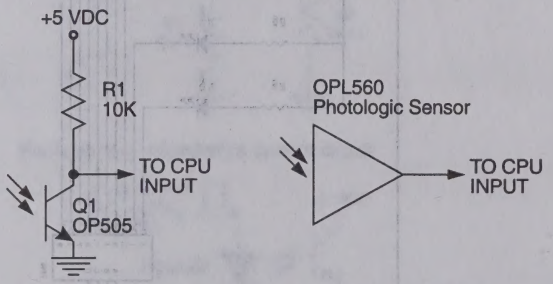



**Figure 2**

Another application might be to have eight different sensor locations operate as digital inputs. This can be accomplished by using phototransistors and a pull-up resistor or a Photologic sensor as shown in Figure 2. These devices would be connected directly to a CPU input. This approach would be much faster but it will not provide as much information about the state of the sensor channel.

Once you have introduced an CPU into your sensing application, the door is open for all sorts of possibilities. For instance, you may want to dynamically adjust the LED drive current for sensing conditions. Another possibility would be to monitor the signals while watching for a particular sensor signature which signals the occurrence of an event. Finally, you may want to add a temperature sensor to the system and use this data to factor out the temperature effects on the sensor.

**Bob Stricklin**
**Technical Marketing Specialist**



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

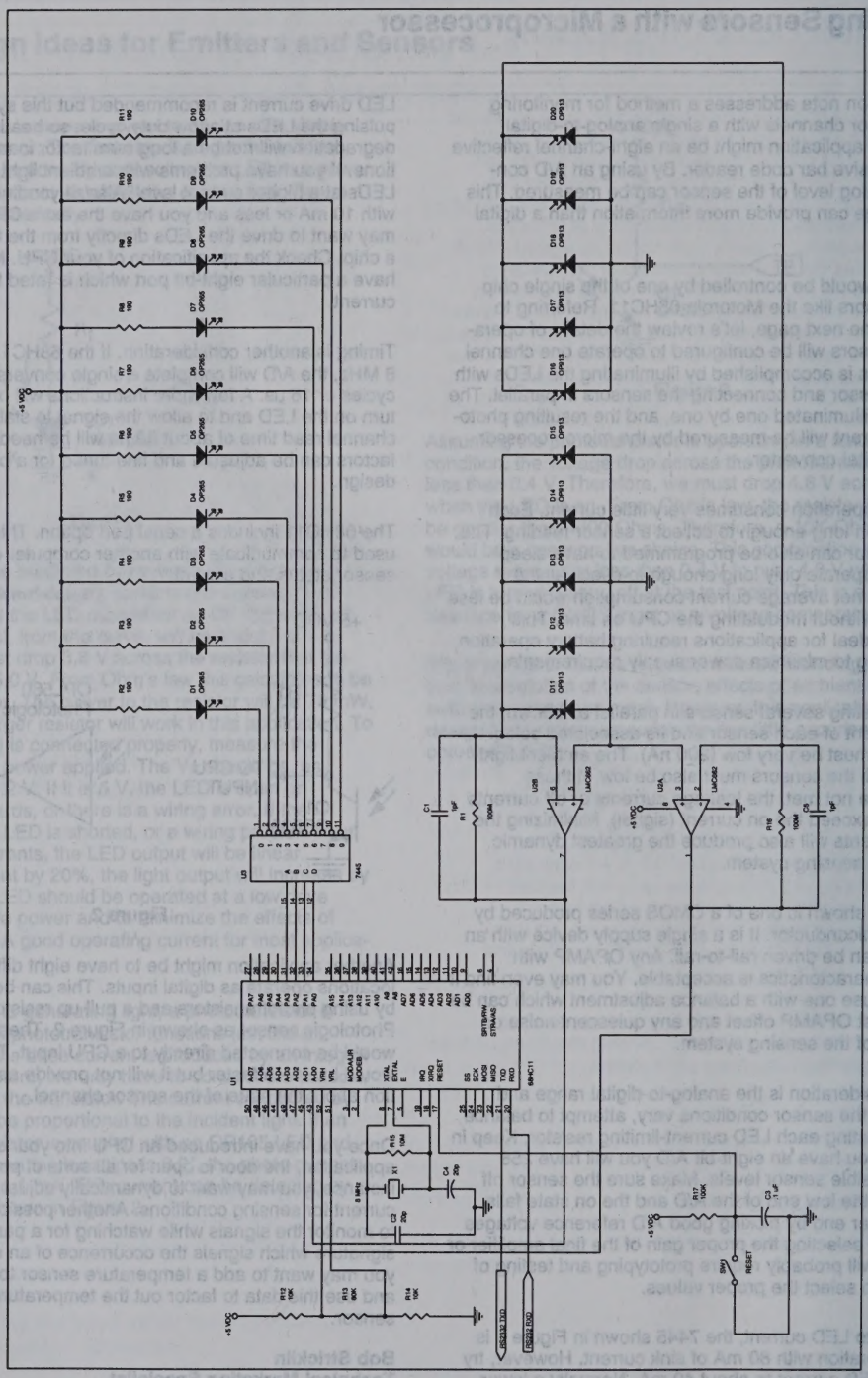


**Figure 1**

# Maximizing Power Output Using the OP232W

What can Optek offer the customer that was using the OP233W in high power output applications? There are too many possible variations of design for there to be a simple answer. Following are a few suggestions:

The simplest option may be to increase the forward current to obtain the same output from the OP232W. Although the data sheet ratings have not been modified over the years, current production is significantly more reliable at higher drive currents than when the OP230W series was first produced in 1980. Provided the customer's circuitry can support the higher power supply loading, this may only require changing the value of a single resistor.

As another option, many customers will find that the OP293 series plastic components are easily substituted for the OP233W. Both are wide angle radiators (50 degree ½ angle for the OP233W, 60 degrees for the OP293), and in many applications the OP293 can fit into the same boards and sockets with no modifications. For those who can use this substitution, the higher on axis intensity available in the plastic component may actually offer improved performance. The main differences to be considered are the plastic versus hermetic construction and the overall package height of the OP293 product series.

Depending on the application it may be reasonable to adopt a pulsed mode operation utilizing the fact that the instantaneous power output can be very high while the average power is low. The circuitry involved is more complex than for a DC operating condition but need not be prohibitively complex or expensive. If the detector can be operated synchronously with the LED drive pulse there need be no loss of speed or sensitivity. Should synchronous operation not be practical but system response speed not be an issue, the detector can be used in an integrating mode with no loss in signal levels. See the following example.

## Example: Replacing a DC circuit with a pulsed circuit

Assumptions:

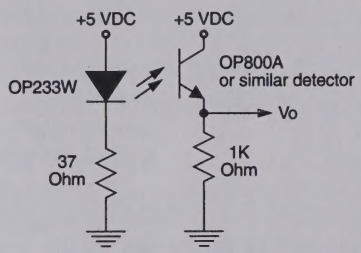
Application is an interrupter sensing whether an object is present in the optical path.

Response speed is not a critical issue.

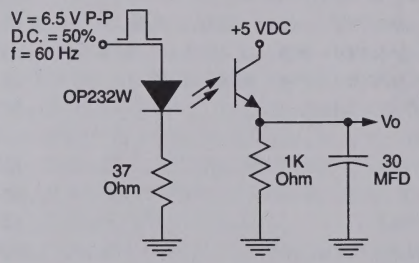
Required output is $V_O$ > 1 V unblocked, $V_O$ < .1 V blocked.

The optical path is such that an OP233W with $E_e$(APT) = 6 mW/cm$^2$ is adequate but an OP232W with $E_e$(APT) = 4 mW/cm$^2$ is not.

Original circuit with DC current drive to LED:




Replacement pulsed drive current circuit:




For the example, the value of $V_O$ would be approximately the same for both circuits in either the blocked or open optical path condition. However, the response time is approximately 10 microseconds for the DC circuit and 10 milliseconds for the pulsed circuit. The speed of the pulsed circuit could be increased by raising the input frequency and reducing the RC product at the output. To maintain a low ripple on the output the RC product should be at least 2× the period of the input pulse waveform.

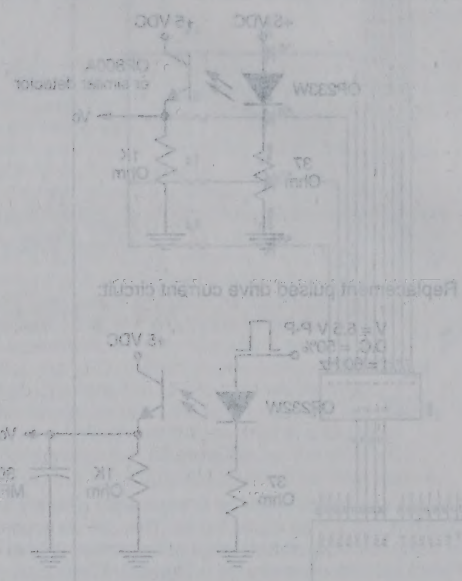
**Jim Woods**



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

## Maximizing Power Output Using the OP233W



# OPTEK TECHNOLOGY, INC.

# INDEX



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

# PRODUCT INDEX


| PART NUMBER | PAGE NO. |
|---|---|
| 3N243, 3N244, 3N245 | 13-4 |
| 3N243TX, 3N244TX, 3N245TX | 13-6 |
| 3N261, 3N262, 3N263 | 13-10 |
| 3N261TX, 3N262TX, 3N263TX | 13-12 |
| 4N22A, 4N23A, 4N24A | 13-16 |
| 4N47, 4N48, 4N49 | 13-26 |
| CNY36 | 12-4 |
| HCC135, HCC136, HCC135TXV, HCC136TXV | 13-30 |
| HCC240, HCC242 | 13-32 |
| HCC247, HCC248, HCC249 | 13-34 |
| HCC340 | 13-36 |
| HCC640(TXV) | 13-38 |
| HCT2222A/TX | 16-8 |
| HCT2222M/TX | 16-10 |
| HCT700 | 16-12 |
| HCT7000M | 16-26 |
| HCT720 | 16-14 |
| HCT740 | 16-16 |
| HCT780 | 16-18 |
| HCT790 | 16-20 |
| HCT801 | 16-22 |
| HCT802 | 16-24 |
| HDA140A | 13-40 |
| HDC135, HDC136, HDC135TXV, HDC136TXV | 13-42 |
| JANTX - 2N2907AUA/TXV | 16-2 |
| JANTX - 2N2907AUB/TXV | 16-4 |
| JANTX, JANTXV - 4N22A, 4N23A, 4N24A | 13-18 |
| JANTX, JANTXV - 4N22AU, 4N23AU, 4N24AU | 13-22 |
| JANTX, JANTXV - 4N47, 4N48, 4N49 | 13-28 |
| JANTX/TXV - 2N4854U | 16-6 |
| OH090U | 10-4 |
| OH180U | 10-6 |
| OH360U | 10-8 |
| OHN3013U | 10-10 |
| OHN3019U, OHS3019U | 10-12 |
| OHN3020U, OHS3020U | 10-14 |
| OHN3030U, OHS3030U | 10-16 |
| OHN3040U, OHS3040U | 10-18 |
| OHN3075U, OHS3075U | 10-20 |
| OHN3113U, OHS3113U | 10-22 |
| OHN3119U, OHS3119U | 10-24 |
| OHN3120U, OHS3120U | 10-26 |
| OHN3130U, OHS3130U | 10-28 |
| OHN3131U, OHS3131U | 10-30 |
| OHN3140U, OHS3140U | 10-32 |
| OHN3175U, OHS3175U | 10-34 |
| OHN3177U, OHS3177U | 10-36 |
| OMF320TX, OMF320TXV | 14-2 |
| OMF321TX, OMF321TXV | 14-4 |

| PART NUMBER | PAGE NO. |
|---|---|
| OMF322TX, OMF322TXV | 14-6 |
| OMF340TX, OMF340TXV | 14-8 |
| OMF341TX, OMF341TXV | 14-10 |
| OMF342TX, OMF342TXV | 14-12 |
| OMF345TX, OMF345TXV | 14-14 |
| OMF346TX, OMF346TXV | 14-16 |
| OMF347TX, OMF347TXV | 14-18 |
| OMF420TX, OMF420TXV | 14-20 |
| OMF421TX, OMF421TXV | 14-22 |
| OMF422TX, OMF422TXV | 14-24 |
| OMF430TX, OMF430TXV | 14-26 |
| OMF431TX, OMF431TXV | 14-28 |
| OMF432TX, OMF432TXV | 14-30 |
| OMH090B, OMH090S | 15-2 |
| OMH3019B, OMH3019S | 15-4 |
| OMH3020B, OMH3020S | 15-6 |
| OMH3040B, OMH3040S | 15-8 |
| OMH3075B, OMH3075S (Bi-Polar Latching) | 15-10 |
| OMH3131B, OMH3131S | 15-12 |
| OMH360B, OMH360S | 15-14 |
| OP123, OP124 | 2-4 |
| OP130, OP131, OP132, OP133 | 2-6 |
| OP130W, OP131W, OP132W, OP133W | 2-8 |
| OP140A, OP140B, OP140C, OP140D | 2-10 |
| OP145A, OP145B, OP145C, OP145D | 2-12 |
| OP163A, OP163B, OP163C, OP163D | 2-14 |
| OP164A, OP164B, OP164C, OP164D | 2-16 |
| OP165A, OP165D | 2-18 |
| OP165W | 2-20 |
| OP166A, OP166B, OP166C, OP166D | 2-22 |
| OP166W | 2-24 |
| OP168FA, OP168FB, OP168FC | 2-26 |
| OP169A, OP169B, OP169C | 2-28 |
| OP223, OP224 | 2-30 |
| OP223TX, OP223TXV, OP224TX, OP224TXV | 13-44 |
| OP231, OP232, OP233 | 2-32 |
| OP231W, OP232W | 2-34 |
| OP235TX, OP235TXV, OP236TX, OP236TXV | 13-48 |
| OP240A, OP240B, OP240C, OP240D | 2-36 |
| OP245A, OP245B, OP245C, OP245D | 2-38 |
| OP265A, OP265B, OP265C, OP265D | 2-40 |
| OP265W | 2-42 |
| OP266A, OP266B, OP266C, OP266D | 2-44 |
| OP266W | 2-46 |
| OP268FA, OP268FB, OP268FC | 2-48 |
| OP269A,B,C | 2-50 |
| OP290, OP291, OP292 Series | 2-52 |
| OP293 and OP298 Series | 2-56 |
| OP294, OP299 | 2-60 |

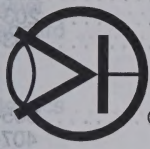
| PART NUMBER | PAGE NO. |
|---|---|
| OP295, OP296, OP297 Series | 2-62 |
| OP300SL, OP301SL, OP302SL, OP303SL, OP304SL, OP305SL | 3-4 |
| OP505A, OP505B, OP505C, OP505D | 3-6 |
| OP505W | 3-8 |
| OP506A, OP506B, OP506C, OP506D | 3-10 |
| OP506W | 3-12 |
| OP508FA, OP508FB, OP508FC | 3-14 |
| OP509A,B,C | 3-16 |
| OP535A, OP535B, OP535C | 3-18 |
| OP538FA, OP538FB, OP538FC | 3-20 |
| OP550A, OP550B, OP550C, OP550D | 3-22 |
| OP555A, OP555B, OP555C, OP555D | 3-24 |
| OP560A, OP560B, OP560C | 3-26 |
| OP565A, OP565B, OP565C | 3-28 |
| OP593, OP598 Series | 3-30 |
| OP599A, OP599B, OP599C, OP599D | 3-34 |
| OP600A, OP600B, OP600C | 3-36 |
| OP602TX/V, OP603TX/V, OP604TX/V | 13-52 |
| OP641SL, OP642SL, OP643SL, OP644SL | 3-38 |
| OP800A, OP800B, OP800C, OP800D | 3-40 |
| OP800SL, OP801SL, OP802SL, OP803SL, OP804SL, OP805SL | 3-42 |
| OP800WSL, OP801WSL, OP802WSL | 3-44 |
| OP803TX/TXV, OP804TX/TXV, OP805TX/TXV | 13-56 |
| OP830SL | 3-46 |
| OP830WSL | 3-48 |
| OP900SL | 3-50 |
| OP913SL, OP913WSL | 3-52 |
| OPB120A, OPB120B Series | 12-6 |
| OPB606A, OPB606B, OPB606C | 11-4 |
| OPB607A, OPB607B, OPB607C | 11-6 |
| OPB610 | 12-10 |
| OPB615, OPB616, OPB617, OPB618 | 12-12 |
| OPB620 | 12-16 |
| OPB625, OPB626, OPB627, OPB628 | 12-18 |
| OPB660 | 12-22 |
| OPB665N/T, OPB666N/T, OPB667N/T, OPB668N/T | 12-26 |
| OPB680 | 12-32 |
| OPB685, OPB686, OPB687, OPB688 | 12-34 |
| OPB690 | 12-38 |
| OPB695, OPB696, OPB697, OPB698 | 12-40 |
| OPB700, OPB700AL | 11-8 |
| OPB700TX, OPB700TXV | 13-60 |
| OPB701, OPB701AL | 11-10 |
| OPB703, OPB704, OPB705 | 11-12 |
| OPB703W, OPB704W, OPB705W | 11-14 |
| OPB706A, OPB706B, OPB706C | 11-16 |

| PART NUMBER | PAGE NO. |
|---|---|
| OPB707A, OPB707B, OPB707C | 11-18 |
| OPB708, OPB709 | 11-20 |
| OPB710, OPB710F | 11-24 |
| OPB711 | 11-26 |
| OPB712 | 11-28 |
| OPB730, OPB730F | 11-30 |
| OPB740, OPB741, OPB742, OPB743, OPB744 | 11-32 |
| OPB740W, OPB741W, OPB742W, OPB743W, OPB744W | 11-34 |
| OPB745 | 11-36 |
| OPB745W | 11-38 |
| OPB750N | 11-40 |
| OPB750T | 11-42 |
| OPB755N | 11-44 |
| OPB755T | 11-46 |
| OPB760N, OPB761N, OPB762N, OPB763N | 11-48 |
| OPB760T, OPB761T, OPB762T, OPB763T | 11-51 |
| OPB770N, OPB771N, OPB772N, OPB773N | 11-54 |
| OPB770T, OPB771T, OPB772T, OPB773T | 11-57 |
| OPB800L/OPB810L Series | 12-46 |
| OPB800W/OPB810W Series | 12-50 |
| OPB804 | 12-54 |
| OPB806 | 12-56 |
| OPB818 | 12-58 |
| OPB820, OPB820S10, OPB820S5, OPB820S3 | 12-60 |
| OPB821, OPB821S10, OPB821S5, OPB821S3 | 12-62 |
| OPB821TX, OPB821TXV | 13-62 |
| OPB822S, OPB821SD | 12-64 |
| OPB825, OPB825A, OPB825B | 12-66 |
| OPB826S, OPB826SD | 12-68 |
| OPB827A, OPB827B, OPB827C, OPB827D | 12-70 |
| OPB828A, OPB828B, OPB828C, OPB828D | 12-72 |
| OPB829A, OPB829B, OPB829C, OPB829D | 12-74 |
| OPB830L, OPB840L Series | 12-76 |
| OPB830W, OPB840W Series | 12-80 |
| OPB844A, OPB844B | 12-84 |
| OPB845A, OPB845B | 12-86 |
| OPB847, OPB848 | 12-88 |
| OPB847TX, OPB847TXV, OPB848TX, OPB848TXV | 13-64 |
| OPB850 | 12-90 |
| OPB852A1, OPB852A2, OPB852A3 | 12-92 |
| OPB853A1, OPB853A2, OPB853A3 | 12-94 |
| OPB854A1, OPB854B1 | 12-96 |
| OPB854A2, OPB854B2 | 12-98 |
| OPB854A3, OPB854B3 | 12-100 |
| OPB855 | 12-102 |
| OPB856 | 12-104 |
| OPB857 | 12-106 |

OPTEK


| PART NUMBER | PAGE NO. |
|---|---|
| OPB859 | 12-108 |
| OPB860, OPB870 Series | 12-110 |
| OPB870L, OPB870N, OPB870P, OPB870T Series | 13-66 |
| OPB880, OPB890 Series | 12-114 |
| OPB900L/OPB910L Wide Gap Series | 12-118 |
| OPB900W/OPB910W Wide Gap Series | 12-122 |
| OPB930L/OPB940L Series | 12-126 |
| OPB930W/OPB940W Series | 12-130 |
| OPB960/OPB970 Series | 12-134 |
| OPB980/OPB990 Series | 12-140 |
| OPC126 | 7-4 |
| OPC200 | 7-5 |
| OPC216 | 7-6 |
| OPC226 | 7-7 |
| OPC260 | 7-8 |
| OPC300R | 7-9 |
| OPC8320, OPC8321, OPC8322, OPC8323 | 7-10 |
| OPC8324, OPC8325, OPC8326, OPC8327 | 7-12 |
| OPC922 | 7-15 |
| OPC9XXX | 7-14 |
| OPF1402, OPF1402(SMA), OPF1412, OPF1414(ST) | 8-4 |
| OPF2404(SMA), OPF2414(ST) | 8-6 |
| OPF2406(SMA), OPF2416(ST) | 8-8 |
| OPF320A, OPF320B, OPF320C | 8-10 |
| OPF321A, OPF321B, OPF321C | 8-12 |
| OPF322A, OPF322B, OPF322C | 8-14 |
| OPF340A, OPF340B, OPF340C, OPF340D | 8-16 |
| OPF341A, OPF341B, OPF341C, OPF341D | 8-18 |
| OPF342A, OPF342B, OPF342C, OPF342D | 8-20 |
| OPF345A, OPF345B, OPF345C, OPF345D | 8-22 |
| OPF346A, OPF346B, OPF346C, OPF346D | 8-24 |
| OPF347A, OPF347B, OPF347C, OPF347D | 8-26 |
| OPF370A, OPF370B, OPF370C, OPF370D | 8-28 |
| OPF371A, OPF371B, OPF371C, OPF371D | 8-30 |
| OPF372A, OPF372B, OPF372C, OPF372D | 8-32 |
| OPF390A, OPF390B, OPF390C, OPF390D | 8-34 |
| OPF391A, OPF391B, OPF391C, OPF391D | 8-36 |
| OPF392A, OPF392B, OPF392C, OPF392D | 8-38 |
| OPF395A, OPF395B, OPF395C, OPF395D | 8-40 |
| OPF396A, OPF396B, OPF396C, OPF396D | 8-42 |
| OPF397A, OPF397B, OPF397C, OPF397D | 8-44 |
| OPF420 | 8-46 |
| OPF421 | 8-48 |
| OPF422 | 8-50 |
| OPF430 | 8-52 |
| OPF431 | 8-54 |
| OPF432 | 8-56 |

| PART NUMBER | PAGE NO. |
|---|---|
| OPF470 | 8-58 |
| OPF471 | 8-60 |
| OPF472 | 8-62 |
| OPF480 | 8-64 |
| OPF481 | 8-66 |
| OPF482 | 8-68 |
| OPF540 | 8-70 |
| OPF541 | 8-72 |
| OPF542 | 8-74 |
| OPI110, OPI110A, OPI110B, OPI110C, OPI113 | 6-4 |
| OPI120, OPI123 | 6-6 |
| OPI120TX, OPI120TXV | 13-70 |
| OPI125, OPI126, OPI127, OPI128 | 6-8 |
| OPI125TXV | 13-72 |
| OPI1264, OPI1264A, OPI1264B, OPI1264C | 6-12 |
| OPI1266 | 6-14 |
| OPI150, OPI153 | 6-16 |
| OPI150TX, OPI150TXV | 13-74 |
| OPI210, OPI211 | 13-76 |
| OPI340 | 13-78 |
| OPI7002, OPI7010 | 6-18 |
| OPI7320, OPI7340 | 6-20 |
| OPL550, OPL551 Series | 4-4 |
| OPL560, OPL561, OPL562, OPL563 Series | 4-8 |
| OPL583 | 4-12 |
| OPL800, OPL801 Series | 4-16 |
| OPL800TXV | 13-80 |
| OPL810, OPL811, OPL812, OPL813 Series | 4-20 |
| OPR2100 | 9-16 |
| OPR5001B, OPR5002B, OPR5003B | 9-17 |
| OPR5005 | 9-20 |
| OPR5200 | 9-22 |
| OPR5500 | 9-23 |
| OPR5910 | 9-24 |
| OPR5911 | 9-25 |
| OPR5913 | 9-26 |
| OPR5915 | 9-27 |
| OPR5925 | 9-28 |
| OPR5929 | 9-29 |
| OPS665, OPS666, OPS667 | 5-2 |
| OPS690, OPS691, OPS692, OPS693 | 5-4 |
| OPS695, OPS696, OPS697, OPS698 | 5-6 |



OPTEK TECHNOLOGY, INC.

# AUTHORIZED DISTRIBUTORS AND SALES OFFICES



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

## AUTHORIZED DISTRIBUTORS

### Alabama

| | |
|---|---|
| Arrow Electronics | 205-837-6955 |
| Future Electronics | 205-830-2322 |
| Hamilton/Avnet | 205-837-7210 |
| Pioneer Technologies | 205-837-9300 |

### Arizona

| | |
|---|---|
| Arrow Electronics | 602-431-0030 |
| A.V.E.D., Rocky Mtn. | 602-951-9788 |
| Bell Industries | 602-966-3600 |
| Future Electronics | 602-968-7140 |
| Hamilton/Avnet | 602-961-6403 |
| | 602-902-4700 |

### California

| | |
|---|---|
| Added-Value | 619-558-8890 |
| | 714-259-8258 |
| | 209-734-8861 |
| Arrow Electronics | 818-880-9686 |
| | 818-701-7500 |
| | 510-490-9477 |
| | 510-487-8416 |
| | 619-565-4800 |
| | 408-453-1620 |
| | 714-544-0200 |
| Bell Industries | 714-895-7801 |
| | 310-826-2355 |
| | 408-734-8570 |
| | 818-340-1940 |
| | 619-268-1277 |
| Future Electronics | 818-772-6240 |
| | 714-250-4141 |
| | 619-625-2800 |
| | 408-434-1122 |
| Hamilton/Avnet | 714-641-4150 |
| | 213-558-2000 |
| | 916-781-6614 |
| | 619-571-7540 |
| | 408-743-3300 |
| | 818-594-0404 |
| J.I.T. Supply | 714-256-9100 |
| | 805-237-2220 |
| | 209-784-2770 |
| Newark Electronics | 310-672-8548 |
| Pioneer Technologies | 619-434-4187 |
| | 408-954-9100 |
| Pioneer Standard | 714-753-5090 |
| | 818-865-5800 |
| Time | 619-578-2500 |
| | 408-734-9888 |
| | 818-593-8400 |

### Colorado

| | |
|---|---|
| Added Value | 303-422-1701 |
| Arrow Electronics | 303-375-1300 |
| Bell Industries | 303-424-1985 |
| Future Electronics | 303-421-0123 |
| Hamilton/Avnet | 719-637-0055 |
| | 303-799-0663 |
| Newark Electronics | 303-373-4540 |

### Connecticut

| | |
|---|---|
| Arrow Electronics | 203-265-7741 |
| Bell Industries | 203-269-6801 |
| Future Electronics | 203-743-9594 |
| Hamilton/Avnet | 203-743-9799 |
| Pioneer Standard | 203-929-5600 |

### Florida

| | |
|---|---|
| Arrow Electronics | 305-429-8200 |
| | 407-333-9300 |
| Chip Supply Co. | 407-298-7100 |
| Future Electronics | 407-767-8414 |
| | 813-530-1222 |
| Hamilton/Avnet | 305-733-6300 |
| | 407-628-3888 |
| Pioneer Technologies | 407-834-9090 |
| | 305-428-8877 |

### Georgia

| | |
|---|---|
| Arrow Electronics | 404-497-1300 |
| Bell Industries | 800-525-6666 |
| Future Electronics | 404-441-7676 |
| Hamilton/Avnet | 404-623-5475 |
| Pioneer Technologies | 404-623-1003 |

### Illinois

| | |
|---|---|
| Arrow Electronics | 708-250-0500 |
| Bell Industries | 708-640-1910 |
| Future Electronics | 708-882-1255 |
| Hamilton/Avnet | 708-860-7780 |
| Pioneer Standard | 708-495-9680 |

### Indiana

| | |
|---|---|
| Arrow Electronics | 317-299-2071 |
| Bell Industries | 317-875-8200 |
| Hamilton/Avnet | 317-844-9533 |
| Pioneer Standard | 317-573-0880 |

### Iowa

| | |
|---|---|
| Arrow Electronics | 319-395-7230 |
| Hamilton/Avnet | 319-393-0033 |

### Kansas

| | |
|---|---|
| Arrow Electronics | 913-541-9542 |
| Hamilton/Avnet | 913-888-8900 |

### Kentucky

| | |
|---|---|
| Hamilton/Avnet | 606-259-1475 |

**Maryland**

| | |
|---|---|
| Arrow Electronics | 301-596-7800 |
| | 301-670-1600 |
| Bell Industries | 410-290-5100 |
| Future Electronics | 410-290-0600 |
| Hamilton/Avnet | 301-995-3500 |
| Pioneer Technologies | 301-921-0660 |

**Massachusetts**

| | |
|---|---|
| Arrow Electronics | 508-658-0900 |
| Bell Industries | 508-474-8880 |
| Gerber Electronics | 617-769-6000 |
| Future Electronics | 508-779-3000 |
| Hamilton/Avnet | 508-532-3701 |
| Pioneer Standard | 617-861-9200 |

**Michigan**

| | |
|---|---|
| Arrow Electronics | 313-462-2290 |
| | 616-243-0912 |
| Bell Industries | 313-347-6633 |
| Future Electronics | 313-261-5270 |
| Hamilton/Avnet | 616-531-0345 |
| | 313-347-4271 |
| Pioneer Standard | 616-698-1800 |
| | 313-525-1800 |

**Minnesota**

| | |
|---|---|
| Arrow Electronics | 612-941-5280 |
| Arrow Telemarketing | 612-946-4800 |
| Future Electronics | 612-944-2200 |
| Hamilton/Avnet | 612-932-0678 |
| Newark | 612-331-6350 |
| Pioneer Standard | 612-944-3355 |

**Missouri**

| | |
|---|---|
| Arrow Electronics | 314-567-6888 |
| Future Electronics | 314-469-6805 |
| Hamilton/Avnet | 314-537-4265 |
| Pioneer Standard | 314-542-3077 |

**New Jersey**

| | |
|---|---|
| Arrow Electronics | 609-596-8000 |
| Bell Industries | 201-227-6060 |
| Future Electronics | 201-299-0400 |
| | 609-596-4080 |
| Hamilton/Avnet | 609-424-0110 |
| | 201-575-3490 |
| Pioneer Standard | 201-575-3510 |

**New Mexico**

| | |
|---|---|
| Arrow Electronics | 505-662-0745 |
| Bell Industries | 505-292-2700 |
| Hamilton/Avnet | 505-828-1058 |

**New York**

| | |
|---|---|
| Arrow Electronics | 516-231-1000 |
| | 212-643-1280 |
| | 716-427-0300 |
| Arrow Catalog Div. | 516-467-1000 |
| Arrow International | 516-293-6363 |
| Future Electronics | 516-234-4000 |
| | 716-272-1120 |
| | 315-451-2371 |
| Hamilton/Avnet | 516-434-7420 |
| | 716-475-9140 |
| Pioneer Standard | 607-722-9300 |
| | 716-381-7070 |
| | 516-921-8700 |

**Nevada**

| | |
|---|---|
| Arrow Electronics | 702-331-5000 |

**North Carolina**

| | |
|---|---|
| Arrow Electronics | 919-876-3132 |
| Future Electronics | 704-455-9030 |
| | 919-790-7111 |
| Hamilton/Avnet | 704-527-2485 |
| | 919-878-0819 |
| Pioneer Technologies | 919-460-1530 |

**Ohio**

| | |
|---|---|
| Arrow Electronics | 216-464-6688 |
| | 513-435-5563 |
| | 614-889-9347 |
| | 216-248-3990 |
| Bell Industries | 513-434-8231 |
| | 513-435-8660 |
| Future Electronics | 216-449-6996 |
| Hamilton/Avnet | 513-439-6700 |
| | 216-349-5100 |
| Pioneer Standard | 216-248-8710 |
| | 216-587-3600 |
| | 513-236-9900 |

**Oklahoma**

| | |
|---|---|
| Arrow Electronics | 918-252-7537 |
| Hamilton/Avnet | 918-252-7927 |
| Pioneer Standard | 918-664-7840 |

**Oregon**

| | |
|---|---|
| Arrow Electronics | 503-629-8090 |
| Bell Industries | 503-644-1500 |
| Future Electronics | 503-645-9454 |
| Hamilton/Avnet | 503-526-6200 |

**Pennsylvania**

| | |
|---|---|
| Arrow Electronics | 412-963-6807 |
| Bell Industries | 215-953-2800 |
| Pioneer Technologies | 215-674-4000 |
| | 412-782-2300 |

**South Carolina**

| | |
|---|---|
| Newark Electronics | 803-487-1982 |

**Tennessee**

| | |
|---|---|
| Arrow Electronics | 901-367-0540 |

**Texas**

| | |
|---|---|
| Arrow Electronics | 512-835-4180 |
| | 214-380-6464 |
| | 713-530-4700 |
| Future Electronics | 713-556-8696 |
| | 214-437-2437 |
| Hamilton/Avnet | 512-832-4306 |
| | 214-308-8140 |
| | 713-861-8517 |
| Newark Electronics | 214-494-5911 |
| Pioneer Standard | 512-835-4000 |
| | 214-386-7300 |
| | 713-495-4700 |
| | 512-377-3440 |
| Time | 214-621-0500 |

**Utah**

| | |
|---|---|
| Arrow Electronics | 801-973-6913 |
| A.V.E.D., Rocky Mtn. | 801-975-9500 |
| Bell Industries | 801-255-9611 |
| Future Electronics | 801-972-8489 |
| Hamilton/Avnet | 801-266-2022 |

**Washington**

| | |
|---|---|
| Almac/Arrow | 206-643-9992 |
| Bell Industries | 206-885-9963 |
| Future Electronics | 206-489-3400 |
| Hamilton/Avnet | 206-881-6697 |

**Wisconsin**

| | |
|---|---|
| Arrow Electronics | 414-792-0150 |
| Bell Industries | 414-547-8879 |
| Future Electronics | 414-786-1884 |
| Hamilton/Avnet | 414-784-4511 |
| Pioneer Standard | 414-784-3480 |

**Canada**

| | |
|---|---|
| Arrow Electronics | 514-421-7411 |
| | 416-670-7769 |
| | 418-871-7500 |
| | 613-226-6903 |
| | 604-421-2333 |
| Electrosonic | 604-273-2911 |
| | 403-255-9550 |
| | 204-783-3105 |
| | 416-494-1555 |
| | 613-728-8333 |
| Future Electronics | 403-250-5550 |
| | 403-438-2858 |
| | 416-612-9200 |
| | 613-820-8313 |
| | 514-694-7710 |
| | 418-877-6666 |
| | 604-294-1166 |
| | 204-786-7711 |
| Hamilton/Avnet | 604-420-4101 |
| | 416-677-7432 |
| | 613-226-1700 |
| | 514-335-1000 |

**Puerto Rico**

| | |
|---|---|
| Hamilton/Avnet | 809-731-1110 |

| | |
|---|---|
| *Newark Electronics | 800-367-3573 |

### Alabama
South Atlantic Component Sales
1100 Jordan Lane, Ste D
Huntsville, AL 35816
Tel: . . . . . 205-533-4229
Fax: . . . . . 205-533-5008

### Arizona
Pinnacle Component Sales, Inc.
6728 E. Avalon Drive, Ste B
Scottsdale, AZ 85251
Tel: . . . . . 602-994-0441
Fax: . . . . . 602-994-3638

Pinnacle Component Sales, Inc.
10200 E. Placita Cresta Verde
Tucson, AZ 85749
Tel: . . . . . 602-886-1726
Fax: . . . . . 602-749-5539

### Arkansas
Technology Representatives, Inc.
17311 Dallas Parkway, Ste 140
Dallas, TX 75248
Tel: . . . . . 214-713-9027
Fax: . . . . . 214-931-6159

### California (Northern)
Westrep
3350 Scott Blvd., Bldg. 41
Santa Clara, CA 95054
Tel: . . . . . 408-988-8833
Fax: . . . . . 408-988-3186

### California (Southern) Military Only
Detomasi and Grupp, Inc.
17220 Newhope Street #218
Fountain Valley, CA 92708
Tel: . . . . . 714-434-2988
Fax: . . . . . 714-434-3823

Detomasi and Grupp Inc.
10550 Sepulveda Blvd., Ste 204
Mission Hills, CA 91345
Tel: . . . . . 818-365-8285
Fax: . . . . . 818-365-5768

### California (Southern) Commercial Only
Westrep
2557 West-Woodland Dr.
Anaheim, CA 92801
Tel: . . . . . 714-527-2822
Fax: . . . . . 714-527-3868

### California (San Diego) Commercial Only
Westrep
16885 W. Bernardo Dr., Ste #285
San Diego, CA 92127
Tel: . . . . . 619-674-1880
Fax: . . . . . 619-674-1878

### Colorado
Waugaman Associates
4800 Van Gordon
Wheat Ridge, CO 80033
Tel: . . . . . 303-423-1020
Fax: . . . . . 303-467-3095

### Connecticut
VISTAssociates, Inc.
2505 Main St.
Stratford, CT 06497
Tel: . . . . . 203-375-5456
Fax: . . . . . 203-375-6907

### Delaware
L.D. Lowery, Inc.
2801 W. Chester Pike
Broomall, PA 19008
Tel: . . . . . 215-356-5300
Fax: . . . . . 215-356-8710

### Florida
South Atlantic Component Sales
6220 S. Orange Blossom Tr., Ste 151
Orlando, FL 32809
Tel: . . . . . 407-857-3650
Fax: . . . . . 407-857-3298

South Atlantic Component Sales
1499 SW 5th Ave.
Boca Raton, FL 33432
Tel: . . . . . 407-391-1034
Fax: . . . . . 407-391-1034

South Atlantic Component Sales
14240 Passage Way
Seminole, FL 34646
Tel: . . . . . 813-595-6397
Fax: . . . . . 813-595-6397

### Georgia
South Atlantic Component Sales
3300 Holcomb Bridge Rd., Ste 210
Norcross, GA 30092
Tel: . . . . . 404-447-6154
Fax: . . . . . 404-447-6714

### Idaho (Northern)
Electra Technical Sales
11411 N.E. 124th St.
Kirkland, WA 98034
Tel: . . . . . 206-821-7442
Fax: . . . . . 206-821-7289

### Idaho (Southern)
Waugaman Assoc. Utah, Inc.
876 East Vine St.
Murray, UT 84107
Tel: . . . . . 801-261-0802
Fax: . . . . . 801-261-0830

### Illinois (Northern)
KMA Sales Company
1040 S. Arlington Heights Rd.
Arlington Heights, IL 60005
Tel: . . . . . 708-398-5300
Fax: . . . . . 708-398-5708

### Illinois (Southern)
John G. Macke Co.
11710 Administration Dr., Ste 31
St. Louis, MO 63146
Tel: . . . . . 314-432-2830
Fax: . . . . . 314-432-1456

### Indiana
Electronic Sales & Engineering, Inc.
P.O. Box 50009
7739 East 88th Street
Indianapolis, IN 46250
Tel: . . . . . 317-849-4260
Fax: . . . . . 317-841-0231

### Iowa
C.H. Horn & Associates
4403 First Ave., Ste 411
Cedar Rapids, IA 52407
Tel: . . . . . 319-393-8703
Fax: . . . . . 319-393-7224

### Kansas
S. W. Associates Inc.
RR1, Box 66A
Parker, KS 66072-9732
Tel: . . . . . 913-898-6552
Fax . . . . . 913-898-6081

### Kentucky
Midwest Marketing Associates
30 Marco Lane
Dayton, OH 45458
Tel: . . . . . 513-433-2511
Fax: . . . . . 513-433-6853

### Louisiana (Northern)
Technology Representatives, Inc.
17311 Dallas Parkway, Ste 140
Dallas, TX 75248
Tel: . . . . . 214-713-9027
Fax: . . . . . 214-931-6159

### Louisiana (Southern)
Technology Representatives, Inc.
7801 N. Lamar, Ste D-96
Austin, TX 78752
Tel: . . . . . 512-452-2110
Fax: . . . . . 512-458-6461

### Maine
VISTAssociates, Inc.
237 Cedar Hill St., Box 388
Marlborough, MA 01752
Tel: . . . . . 508-481-9277
Fax: . . . . . 508-460-1869

### Maryland
L.D. Lowery, Inc.
2801 W. Chester Pike
Broomall, PA 19008
Tel: . . . . . 215-356-5300
Fax: . . . . . 215-356-8710

### Massachusetts
VISTAssociates, Inc.
237 Cedar Hill St.,
Marlborough, MA 01752
Tel: . . . . . 508-481-9277
Fax: . . . . . 508-460-1869

### Michigan
AP Associates, Inc.
P.O. Box 777
810 E. Grand River Ave.
Brighton, MI 48116
Tel: . . . . . 313-229-6550
Fax: . . . . . 313-229-9356

### Minnesota
TECTEAM Sales, Inc.
3050 Metro Drive, Ste 301
Bloomington, MN 55425
Tel: . . . . . 612-854-6616
Fax: . . . . . 612-854-8031

### Mississippi
South Atlantic Component Sales
1100 Jordan Lane, Ste D
Huntsville, AL 35816
Tel: . . . . . 205-533-4229
Fax: . . . . . 205-533-5008

### Missouri
John G. Macke Co.
11710 Administration Dr., Ste 31
St. Louis, MO 63146
Tel: . . . . . 314-432-2830
Fax: . . . . . 314-432-1456

### Montana
Waugaman Associates
4800 Van Gordon
Wheat Ridge, CO 80033
Tel: . . . . . 303-423-1020
Fax: . . . . . 303-467-3095

### Nebraska (Western)
Waugaman Associates
4800 Van Gordon
Wheat Ridge, CO 80033
Tel: . . . . . 303-423-1020
Fax: . . . . . 303-467-3095

### Nebraska (Eastern)
S.W. Associates, Inc
RR1, Box 66A
Parker, KS 66072-9732
Tel: . . . . . 913-898-6552
Fax: . . . . . 913-898-6081

### Nevada (Northern)
Westrep
3350 Scott Blvd., Bldg. #41
Santa Clara, CA 95054
Tel: . . . . . 408-988-8833
Fax: . . . . . 408-988-3186

### Nevada (Southern) Commercial Only
West Rep
2557 West-Woodland Dr.
Anaheim, CA 92801
Tel: . . . . . 714-527-2822
Fax: . . . . . 714-527-3868

### New Hampshire
VISTAssociates, Inc.
P.O. Box 388
237 Cedar Hill St.,
Marlborough, MA 01752
Tel: . . . . . 508-481-9277
Fax: . . . . . 508-460-1869

### New Jersey (Southern)
L.D. Lowery, Inc.
2801 W. Chester Pike
Broomall, PA 19008
Tel: . . . . . 215-356-5300
Fax: . . . . . 215-356-8710

### New Jersey (Northern)
Technical Marketing Group
175-3C Fairfield Ave.
West Caldwell, NJ 07666
Tel: . . . . . 201-226-3300
Fax: . . . . . 201-226-9518

### New Mexico
S. W. Sales, Inc.
7137 Settlement Way, NW
Albuquerque, NM 87120
Tel: . . . . . 505-899-9005
Fax: . . . . . 505-899-8903

### New York
KLM Garner
46 Clinton St.
Clark Mills, NY 13321
Tel: . . . . . 315-853-6126
Fax: . . . . . 315-853-3011

KLM Garner
111 Marsh Rd.
Pittsford, NY 14534
Tel: . . . . . 716-381-8350
Fax: . . . . . 716-381-6703

### New York (NYC & Long Island)
Technical Marketing Group
20 Broad Hollow Rd.
Melville, NY 11747
Tel: . . . . . 516-351-8833
Fax: . . . . . 516-351-8667

### North Carolina
South Atlantic Component Sales
4904 Waters Edge Drive, Ste 268
Raleigh, NC 27606
Tel: . . . . . 919-859-9970
Fax: . . . . . 919-859-9974

### North Dakota
TECTEAM Sales, Inc.
3050 Metro Drive
Suite 301
Bloomington, MN 55425
Tel: . . . . . 612-854-6616
Fax: . . . . . 612-854-8031

## Ohio

Midwest Marketing Associates
30 Marco Lane
Dayton, OH 45458
Tel: . . . . . 513-433-2511
Fax: . . . . . 513-433-6853

Midwest Marketing Associates
5001 Mayfield Rd., Ste 212
Lyndhurst, OH 44124
Tel: . . . . . 216-381-8575
Fax: . . . . . 216-381-8857

## Oklahoma

Technology Representatives, Inc.
17311 Dallas Parkway, Ste 140
Dallas, TX 75248
Tel: . . . . . 214-713-9027
Fax: . . . . . 214-931-6159

## Oregon

Electra Technical Sales
6700 S.W. 105th Ave., Ste 300
Beaverton, OR 97005
Tel: . . . . . 503-643-5074
Fax: . . . . . 503-526-2055

## Pennsylvania (Eastern)

L.D. Lowery, Inc.
2801 W. Chester Pike
Broomall, PA 19008
Tel: . . . . . 215-356-5300
Fax: . . . . . 215-356-8710

## Pennsylvania (Western)

Midwest Marketing Associates
5001 Mayfield Rd., Ste 217
Lyndhurst, OH 44124
Tel: . . . . . 216-381-8575
Fax: . . . . . 216-381-8857

## Rhode Island

VISTAssociates, Inc.
237 Cedar Hill St., Box 388
Marlborough, MA 01752
Tel: . . . . . 508-481-9277
Fax: . . . . . 508-460-1869

## South Carolina

South Atlantic Component Sales
4904 Waters Edge Dr., Ste 268
Raleigh, NC 27606
Tel: . . . . . 803-732-0816
Fax: . . . . . 803-732-0816

## South Dakota

TECTEAM Sales, Inc.
3050 Metro Drive, Ste 301
Bloomington, MN 55425
Tel: . . . . . 612-854-6616
Fax: . . . . . 612-854-8031

## Tennessee

South Atlantic Component Sales
1100 Jordan Lane, Ste D
Huntsville, AL 35816
Tel: . . . . . 205-533-4229
Fax: . . . . . 205-533-5008

## Texas

Technology Representatives, Inc.
17311 Dallas Parkway, Ste 140
Dallas, TX 75248
Tel: . . . . . 214-713-9027
Fax: . . . . . 214-931-6159

Technology Representatives, Inc.
7801 N. Lamar, Ste D-96
Austin, TX 78752
Tel: . . . . . 512-452-2110
Fax: . . . . . 512-458-6461

S. W. Sales
1930 So. Alma School Rd., #C205
Mesa, AZ 85210
Tel: . . . . . 915-594-8259
Fax: . . . . . 915-592-0288

## Utah

Waugaman Assoc. Utah, Inc.
876 East Vine St.
Murray, UT 84107
Tel: . . . . . 801-261-0802
Fax: . . . . . 801-261-0830

## Vermont

VISTAssociates, Inc.
P.O. Box 388
237 Cedar Hill St.,
Marlborough, MA 01752
Tel: . . . . . 508-481-9277
Fax: . . . . . 508-460-1869

## Virginia

L. D. Lowery, Inc.
2801 W. Chester Pike
Broomall, PA 19008
Tel: . . . . . 215-356-5300
Fax: . . . . . 215-356-8710

## Washington

Electra Technical Sales
11411 N.E. 124th St.
Kirkland, WA 98034
Tel: . . . . . 206-821-7442
Fax: . . . . . 206-821-7289

## West Virginia

Midwest Marketing Associates
30 Marco Lane
Dayton, OH 45458
Tel: . . . . . 513-433-2511
Fax: . . . . . 513-433-6853

## Wisconsin (Northern)

TECTEAM Sales, Inc.
3050 Metro Drive, Ste 301
Bloomington, MN 55425
Tel: . . . . . 612-854-6616
Fax: . . . . . 912-854-8031

## Wisconsin (Southern)

KMA Sales Company
2360 N. 124th St.
Milwaukee, WI 53226
Tel: . . . . . 414-259-1771
Fax: . . . . . 414-259-0246

## Wyoming

Waugaman Associates
4800 Van Gordon
Wheat Ridge, CO 80033
Tel: . . . . . 303-423-1020
Fax: . . . . . 303-467-3095

## Canada

CMT Renmark, Inc.
135 Michael Cowpland Rd., Ste. 201
Kanata, Ontario
Canada K2M 2E9
Tel: . . . . . 613-591-9555
Fax: . . . . . 613-591-9553

CMT Renmark, Inc.
7560 Airport Rd., Unit #5
Mississauga, Ontario
Canada L4T 4H4
Tel: . . . . . 416-612-0900
Fax: . . . . . 416-612-0905

CMT Renmark, Inc.
6600 Transcanada Hwy., Ste. 300
Point Claire, Quebec
Canada H9R 4S2
Tel: . . . . . 514-694-6088
Fax: . . . . . 514-694-1686

April 1993

# INTERNATIONAL SALES OFFICE LOCATIONS

## ARGENTINA
YEL S.R.L.
Virrey Cevallos 143
1077 Buenos Aires
Argentina
TEL:.....54 1 40 1025
54 1 45 7140
FAX: .....54 1 45 2551

## AUSTRALIA
Email Electronics
15-17 Hume Street
Huntingdale Victoria 3166
Australia
TEL:.....61 3 544 8244
FAX: .....61 3 543 8179

## AUSTRIA
Transistor Hitronik
Gudrunstrasse 184/2/2
1100 Wien
Austria
TEL:.....43 1 60 12 90
FAX: .....43 1 60 63 178

## DENMARK
DKI Dansk Komponent Import A/S
Kongevejen 83
DK-2840 Holte
Denmark
TEL:.....45 45 41 0500
FAX: .....45 45 41 0512

## FINLAND
Komdel Oy
P.O. Box 51
SF - 02631 Espoo
Finland
TEL:.....358 0 502 3200
FAX: .....358 0 502 3294

## FRANCE
Avnet Time
79, rue Pierre Semard
92320 Chatillon
France
TEL: 33 1 49 65 2650
FAX: 33 1 49 65 2679

Axess Technology
Z.A.C. du Vaulorin
9, rue Marcelin Berthelot
91320 Wissous
France
TEL:.....33 1 60 11 1110
FAX: .....33 1 60 11 6754

## GERMANY
Fietje Elektronik
Parkstr. 10
18057 Rostock
Germany
TEL:..... 49 3 812 1423
FAX:..... 49 3 812 1423

Getronic GmbH
Warnstedtstrasse 57
22504 Hamburg
Germany
TEL:..... 49 40 540 4046
FAX:..... 49 40 540 6733

IGS-G. Schweiss
Rosenheimer Landstrasse 33A
85521 Ottobrunn
Germany
TEL:..... 49 89 609 3661
FAX:..... 49 89 609 3772

## HONG KONG
Tektron Electronics (HK) Ltd.
1702 Bank Centre
636 Nathan Road
Kowloon
Hong Kong
TEL:..... 852 388 0629
FAX:..... 852 780 5871

## INDIA
New World Electronics
212/203, Copper Arch,
83, Infantry Road,
Bangalore-560, 001,
India
TEL:..... 080 59 1107
FAX:..... 080 59 1056

## ISRAEL
El-Gev Electronics Ltd.
Building 101 P.O.B. 50
Tirat-Yehuda 73175
Israel
TEL:..... 972 3 971 2056
FAX:..... 972 3 971 2407

## ITALY
Dott. Ing. Giuseppe De Mico S.P.A.
Viale Vittorio Veneto 8
20060 Cassina de' Pecchi
Milano
Italy
TEL:..... 39 02 95 20 551
39 02 95 20 651
FAX:..... 39 02 95 22 227
39 02 95 21 912

## JAPAN
Teksel Co. Ltd.
Kanagawa Science Park
3-2-1 , Sakado, Takatsu-Ku
Kawasaki 213
Japan
TEL:.....81 44 812 7430
FAX:.....81 44 812 7433

## KOREA
MS International Corp.
C.P.O. Box 6780
Rm. No. 1205 Haechun Bldg.
#831, Yucksam-Dong
Kangnam-Ku, Seoul,
Korea
TEL:.....82 2 553 0901
FAX:.....82 2 553 0046
82 2 555 5584

## MEXICO
Mak Electronics
Republica De El Salvador 26A,
Centro, 060000
Mexico City D.F.
Mexico
TEL:.....52 5 512 2152
52 5 709 5307
FAX:.....52 5 510 3322

## THE NETHERLANDS
Koning en Hartman B.V.
Energieweg 1
2627 AP Delft
P.O. Box 125
2600 AC Delft
The Netherlands
TEL:.....31 15 60 9906
FAX:.....31 15 61 9194

## NEW ZEALAND
D. Graham Reid Trading As
Professional Electronics
22B Milford Road
P.O. Box 31127
Auckland 9
New Zealand
TEL:.....64 9 410 9690
FAX:.....64 9 410 2971

## NORWAY
Hefro Elektronikk A/S.
P.O. Box 9376
0135 Oslo
Norway
TEL:.....47 22 67 6800
FAX:.....47 22 67 7380

## PUERTO RICO
Pedro E. Conesa Nazario
PECN
P.O. Box 235, Station 6
Ponce, Puerto Rico 00732
TEL:.....809 841 6394
FAX: .....809 259 1272

## SINGAPORE
Seamax Engineering Pte. Ltd.
Blk 6001 Bedok Ind. Park C
#02-2280/2282
Singapore 1647
TEL:.....65 445 1828
FAX: .....65 445 6388
65 241 9422

## SOUTH AFRICA
Communica LTD
P.O. Box 29011
Sunnyside, 0132
Pretoria,
South Africa
TEL:.....27 12 322 76 13/21
FAX: .....27 12 322 37 21

## SPAIN
Amitron S.A.
Avda, De Valladolid, 47D
28008 Madrid
Spain
TEL:.....34 1 542 0906
FAX: .....34 1 541 7655

## SWEDEN
Martinsson Elektronik AB
Instrumentvaegen 16
Box 9060
S-126 09 Haegersten
Sweden
TEL:.....46 8 744 0300
FAX: .....46 8 744 3403

## SWITZERLAND
Memotec AG
Gaswerkstrasse 32
CH-4901 Langenthal
Switzerland
TEL:.....41 63 28 1122
FAX: .....41 63 22 3506

## TAIWAN
Sea Union Engineering Ent. Ltd.
P.O. Box 45-95
3rd Fl., 162, Chang an East Road
Sec. 2
Taipei 10406
Taiwan R.O.C.
TEL: ..... 886 2 751 6856
886 2 751 2063
FAX:..... 886 2 751 6958
886 2 751 2062

## THAILAND
Thai Seamax Electronics Co. Ltd.
93/2 Ekamai Soi 3,
Sukhumvit 63 Bangkok 10110
Thailand
TEL: ..... 66 2 391 7020
FAX:..... 66 2 381 2970

## UNITED KINGDOM
Highland Electronics Limited
Albert Drive
Burgess Hill
West Sussex RH15 9TN
TEL: ..... 44 444 245 021
44 444 236 000
FAX:..... 44 444 236 641

Pacer Components Ltd.
Unit 20, Horseshoe Park
Pangbourne, Reading
Berkshire RG8 7JW
TEL: ..... 44 73 484 5280
FAX:..... 44 73 484 5425

## OPTEK

## REGIONAL OFFICES

## CENTRAL EUROPE
Reiner Dollwetzel
Optek Technology, Inc.
Flemingstrasse 27
91154 Roth
Germany
TEL: ..... 49 91 718 7061
FAX: ..... 49 91 716 3410

## WESTERN EUROPE
Jean Pascal Delaporte
Optek Technology, Inc.
20, rue Lavoisier
95300 Pontoise
France
TEL: ..... 331 34 24 8788
FAX: ..... 331 34 24 8433

April 1993

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

From _____

_____

_____

PLACE
STAMP
HERE

OPTEK TECHNOLOGY, INC.
1215 West Crosby Road
Carrollton, Texas 75006

ATTN: Marketing Department

## Registration Card

Please complete and mail to validate receipt

Date _____

Name _____ Title _____

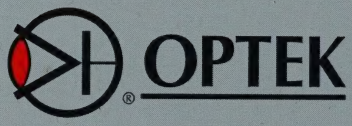
Address _____ Dept. _____

City _____ State _____ Zip _____

**Area of Interest**

- ❑ Opto Discrete Components
- ❑ Opto Slotted Assemblies
- ❑ Opto Reflective Assemblies
- ❑ Hi-Rel
- ❑ Hall Effect
- ❑ Hybrids
- ❑ Fiber Optics
- ❑ Custom Assemblies

❑ **Please Mail Additional Catalog**




**Corporate Headquarters:**
1215 W. Crosby Road Carrollton, TX 75006 Telephone (214) 323-2200 FAX (214) 323-2396

Printed in U.S.A.